Appendix A. Palouse Monitoring Plan

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Palouse River
Monitoring Program 2001-2002

A Water Quality Sampling Project for the 303 (d) listed tributaries of the Palouse River within the State of Idaho.

February 4, 2002

Developed for: **Latah Soil and Water Conservation District (LSWCD)**
Idaho Department of Environmental Quality (DEQ)
Idaho Soil Conservation Commission (SCC)
Idaho State Department of Agriculture (ISDA)

Prepared by: **Cary Myler, Idaho Association of Soil Conservation Districts**

Approved by: ______________________________
Latah Soil and Water Conservation District Chairperson

Approved by: ______________________________
Idaho Department of Environmental Quality Representative

Approved by: ______________________________
Idaho Soil Conservation Commission Representative

Approved by: ______________________________
Idaho State Department of Agriculture Representative

Introduction:

The Palouse River Watershed is comprised of two major forks: the South Fork and North Fork. Each of these segments originate in forest regions in Idaho and flow independently into Washington where they later combine.

The South Fork of the Palouse River is 303 (d) listed from the headwaters to the Idaho-Washington border for bacteria, flow alteration, habitat alteration, nutrients, sediment, and temperature. South Fork Palouse River is a small watershed with 13.42 stream miles from the headwaters to the Idaho-Washington border. This stream flows through forest and agricultural lands southeast of the city of Moscow. Several small farmsteads lie along the watershed providing a sub-urban aspect to the drainage. The South Fork Palouse originates on the southwest slope of Moscow Mountain from five main tributaries: headwaters South Fork Palouse, Howard Creek, Gnat Creek, Crumarine Creek, and Twin Creek. These tributaries are very small in size and combine near the intersection of Robinson Lake Road and Olsen Road.

The North Fork of the Palouse River originates on the western side of the Hoodoo Mountains in the St. Joe National Forest and then flows adjacent to the towns of Harvard, Princeton, and Potlatch before the river crosses into the State of Washington. The North Fork of the Palouse itself is not a 303 (d) listed waterbody but Deep, Gold, Big, Flannigan, West Fork of Rock and Hatter Creeks are 303 (d) impaired streams that are listed for bacteria, flow alteration, habitat alteration, nutrients, and sediment.

Monitoring Program:

This water quality monitoring program is intended to provide background data on the 303 (d) listed tributaries of the Palouse River for TMDL development. This monitoring plan was designed in coordination with the Lewiston Regional Office of the Idaho Department of Environmental Quality (DEQ), Latah Soil and Water Conservation District (LSWCD), and Soil Conservation Commission (SCC) and the Idaho Association of Soil Conservation Districts (IASCD) to fill data gaps that exist in the watershed. Monitoring near the headwaters, the agriculture-forest boundary and near the Idaho-Washington State line will enable managers to determine where loads are entering the stream to allow prioritization for the implementation of Best Management Practices (BMPs).

Specific parameters to be tested are total phosphorus (TP), bacteria (*Escherichia coli* and total coliform), nitrate+nitrite (NO_3+NO_2-N), ammonia (NH_3), turbidity, total suspended solids (TSS), instantaneous water temperature, continuous water temperature, dissolved oxygen (DO), and percent (%) saturation. With the exception of continuous temperature monitoring, the remaining parameters will be monitored on an instantaneous basis with sampling occurring every two weeks. This project is scheduled to begin November 2001 and continue through June 2002, at which time monitoring may continue contingent upon funding availability.

The University of Idaho Analytical Science Laboratory (ASL) will conduct all inorganic parameter testing. Bacteria analysis will be performed by the State of Idaho Health and Welfare Laboratory in Coeur d'Alene. All other measurements will be performed by Cary Myler of the IASCD, or other personnel under supervision. Continuous temperature dataloggers will be installed at representative sites.

This project is a cooperative effort between IASCD, ISDA, DEQ, and SCC. ISDA and IASCD will provide the personnel, sampling equipment, and technical expertise. DEQ will pay all laboratory costs incurred at the U of I ASL for NO_3+NO_2/NH_3, TP, and TSS as well as bacteria costs from the state bacteria laboratory in Coeur d'Alene for the duration of the project and will fund a position at the LSWCD to collect the data. IASCD personnel will conduct the monitoring, perform data entry, and provide a summary report after the data has been gathered.

Program Objectives:

IASCD will cooperate with the (DEQ), (ISDA), (LSWCD) and local landowners in an attempt to complete the following goals:

1. Evaluate the water quality and discharge rates at selected locations on each 303 (d) listed tributary.

2. Attempt to determine which areas contribute to water quality exceedances or degradation.

3. Prioritize loading areas that may require BMP implementation or other possible management strategies.

4. Determine relationship between turbidity and total suspended solids.

5. Make data available to the public.

Site Description:

These sites are shown on the map on page 214.

PR-1 Located at the headwaters on Cedar Grove Lane.

PR-2 Located at Robinson Park.

PR-3 Located at bridge crossing of Mountain view Rd. near Palouse River Drive.

PR-4 Located at the Idaho-Washington State line.

PR-5 Lower Deep Creek at Potlatch (Irelands Café).

PR-6 Middle Deep Creek, located bridge crossing of Freeze Road.

PR-7 Upper Deep Creek.

PR-8 Upper Gold Creek.

PR-9 Lower Gold Creek.

PR-10 Upper Big Creek.

PR-11 Lower Big Creek.

PR-12 Lower Hatter Creek.

PR-13 Upper Hatter Creek.

PR-14 Lower West Fork Rock Gold Creek.

PR-15 Upper West Fork Rock Creek.

PR-16 Lower Flannigan Creek.

PR-17 Upper Flannigan Creek.

Sampling Methods
Water Quality

With the exception of bacteriological samples, each grab sample will be composited into a 2.5-gallon polyethylene churn sample splitter. The resultant composite sample will then be thoroughly homogenized and poured off into properly prepared sample containers. Nutrients water samples that require preservation will be obtained in preserved (H_2SO_4 pH <2) 500 mL. sample containers. The polyethylene churn splitter will be thoroughly rinsed with ambient water at each location prior to sample collection. Bacteriological samples will be collected directly from mid-stream flow into properly prepared sterile sample bottles. Refer to Table A-1 for a list of parameters, analytical methods, preservation, and holding times.

All sample containers will be equipped with sample labels that will be filled out using water proof markers with the following information: station location, sample identification, date of collection, and time of collection. Clear packing tape will be wrapped around each sample bottle and its label to insure that moisture from the coolers does not cause the loss of sample labels. All resultant samples will be placed within a cooler, on ice, to await shipment to the laboratory. Chain-of-Custody forms will accompany each sample shipment. All samples, except bacteria, will be shipped to the University of Idaho ASL for analyses. Bacteria samples will be sent to the State of Idaho Health and Welfare Laboratory in Couer d'Alene for analysis. Samples will be shipped either the same day or early the next morning to meet 30-hour holding time.

Table A-1. Water Quality Parameters

Parameters	Sample Size	Preservation	Holding Time	Method
Non Filterable Residue (TSS)	1L	Cool 4°C	7 Days	EPA 160.2
Nitrogen(NO_3+NO_2) Ammonia (NH_3)	60 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 353.2 EPA 350.1
Total Phosphorus (TP)	100 mL	Cool 4°C, H_2SO_4 pH < 2	28 Days	EPA 365.4
Escherichia coli (E. coli)	100 mL	Cool 4°C	30 Hours	MPN

Field Measurements

At each location, field parameters of dissolved oxygen, specific conductance, pH, temperature and total dissolved solids will be measured. These measurements will be taken, when possible, from a well-mixed section, near mid-stream at approximately mid-depth. Calibration of all field equipment will be in accordance with the manufacturer's specifications. Refer to Table A-2 for a listing of field measurements, equipment and calibration techniques.

Table A-2. Field Measurements

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI Model 55	Ambient air calibration
Temperature	YSI Model 55 StowAway temperature logger Model XTI 02	Centigrade thermometer Centigrade thermometer
Conductance & TDS	Orion Model 115	Specific Conductance (25^{o}C)
PH	Orion Model 210A	Standard buffer (7,10) bracketing for linearity
Turbidity	Hach Model 2100P	Formazin Primary Standard

All field measurements will be recorded in a bound log book along with any pertinent observations about the site, including weather conditions, flow rates, personnel on site or any potential problems observed that may affect the quality of data.

Flow Measurements

Flow measurements will be collected by wading and using a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenth-depth method (0.6 of the total depth below water surface) will be used when the depth of water is less than or equal to three feet. For depths greater than three feet the two-point method (0.2 and 0.8 of the total depth below the water surface) will be employed. At each gauging station, a transect line will be established across the width of the drain/creek at an angle perpendicular to the flow. The mid-section method for computing cross-sectional area along with the velocity-area method will be used for discharge determination. The discharge is computed by summation of the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. This method will be used to calculate cubic feet per second at each of the monitoring stations.

Quality Assurance and Quality Control (QA/QC)

The ASL utilizes methods approved and validated by EPA. A method validation process, including precision and accuracy performance evaluations and method detection limit studies, are required of all of ASL Standard Methods. Method performance evaluations include quality control samples, analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are all part of ASL's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project will consist of duplicates (at 10% of the sample load) along with blank samples (one set per sampling day). The field blanks will consist of laboratory-grade deionized water, transported to the field and poured off into a prepared sample container. The blank sample is used to determine the integrity of the field teams handling of samples, the condition of the sample containers supplied by the laboratory and the accuracy of the laboratory methods. Duplicates consist of two sets of sample containers filled with the same composite water from the same sampling site. The duplicates are used to determine both field and laboratory precision. The duplicate and blank samples will not be identified as such and will enter the laboratories blindly for analyses. Both the duplicates and blank samples will be stored and handled with the normal sample load for shipment to the laboratory.

Bacteria water samples will be shipped from the Idaho Department of Health and Welfare building in Moscow to the laboratory in Couer d'Alene where the samples will be run within the 30 hour holding time. Their procedures use MPN (most probable number) by Quantitray test to determine *E. coli* and total coliform concentrations. The laboratory in Couer d'Alene is certified by the State of Idaho to conduct laboratory analysis of bacteria.

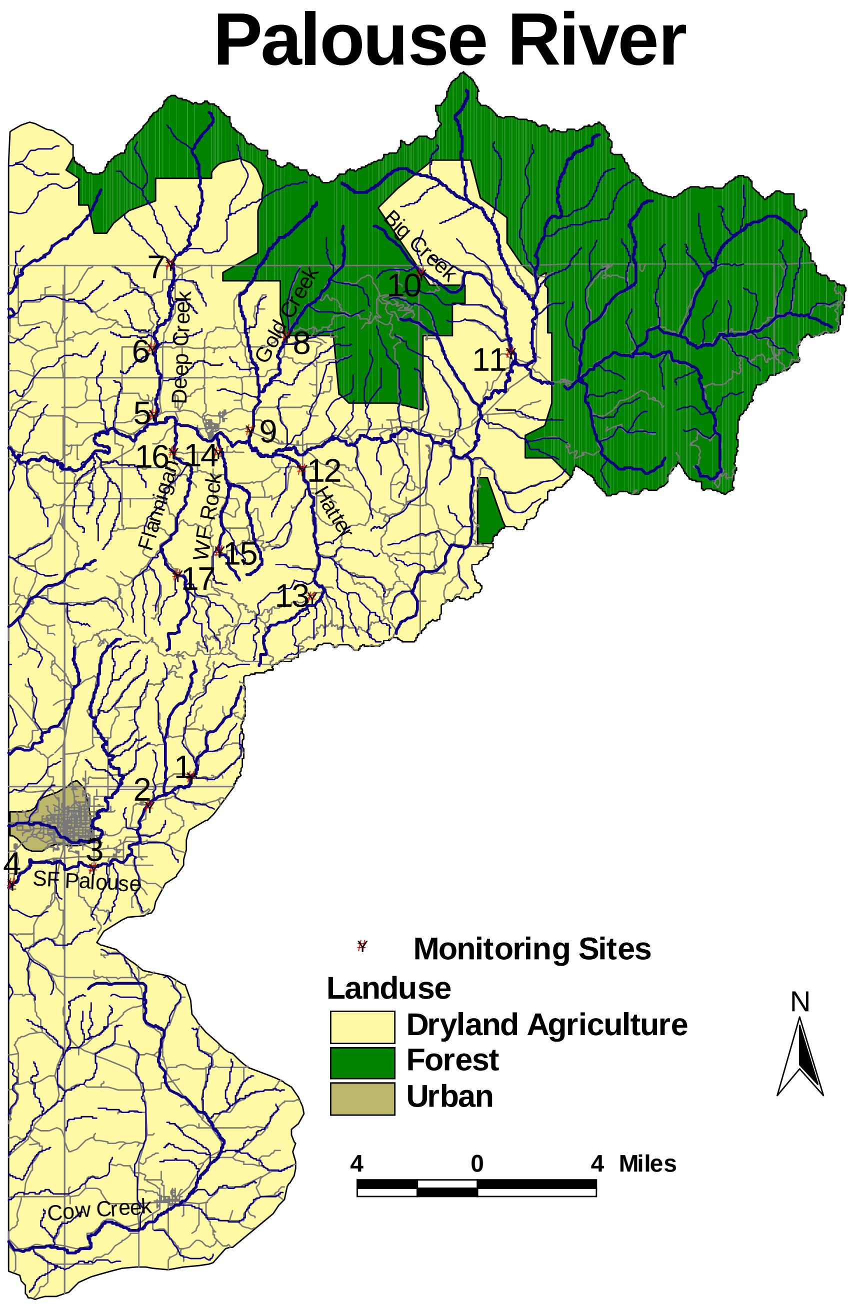
Data Handling

All of the field data and analytical data generated from each survey will be submitted to ISDA for review. Each batch of data from a survey will be reviewed to insure that all necessary observations, measurements, and analytical results have been properly recorded.

The analytical results will be reviewed for completeness and quality control results. Any suspected errors will be investigated and resolved, if possible. The data will then be stored electronically and made available to any interested entity. Monthly progress reports will be sent from the IASCD to the DEQ. These reports will include: a status report of the field monitoring, an electronic copy of the data, and an overall update of the project.

Data use

The data generated from this monitoring program will be used by IASCD, DEQ, SCC, and the LSWCD to determine loads within the stream, identify areas where BMPs would have the greatest benefit, provide baseline data prior to TMDL development, and identify changes as BMPs are implemented. Data will also be available to other agencies and the general public. This data will specifically be used by the DEQ for TMDL development for the Palouse River Watershed.



Map A-1. Monitoring Sites

Appendix B. Sediment TMDL Regression Tables

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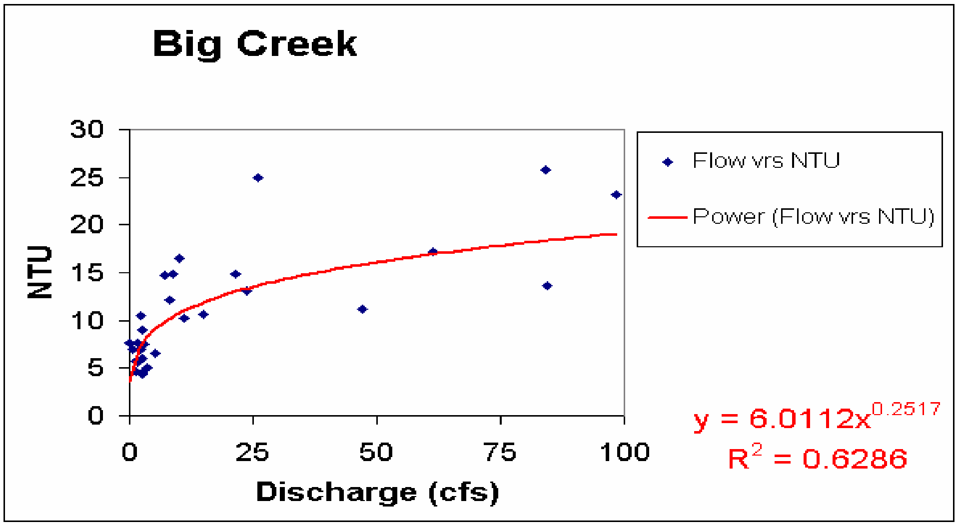
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NTU
Discharge (cfs)
Flow vrs NTU
Power (Flow vrs NTU)
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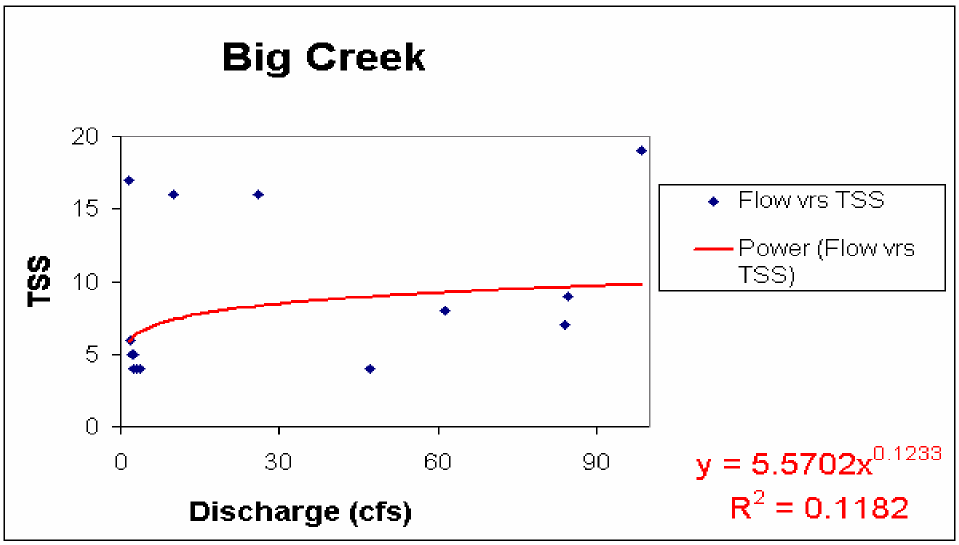
R^2 = 0.6286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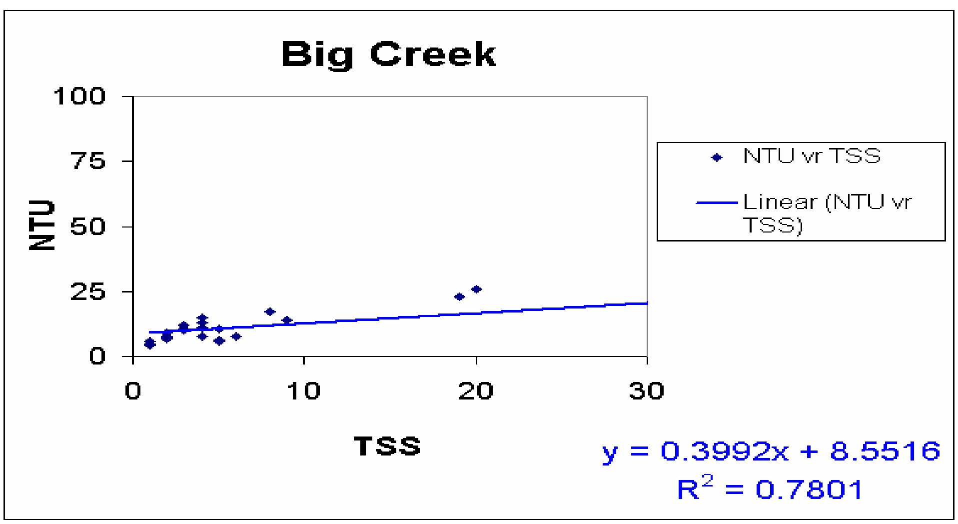
TSS
Discharge (cfs)
Flow vrs TSS
Power (Flow vrs TSS)
y = 5.5702x^0.1233
R^2 = 0.1182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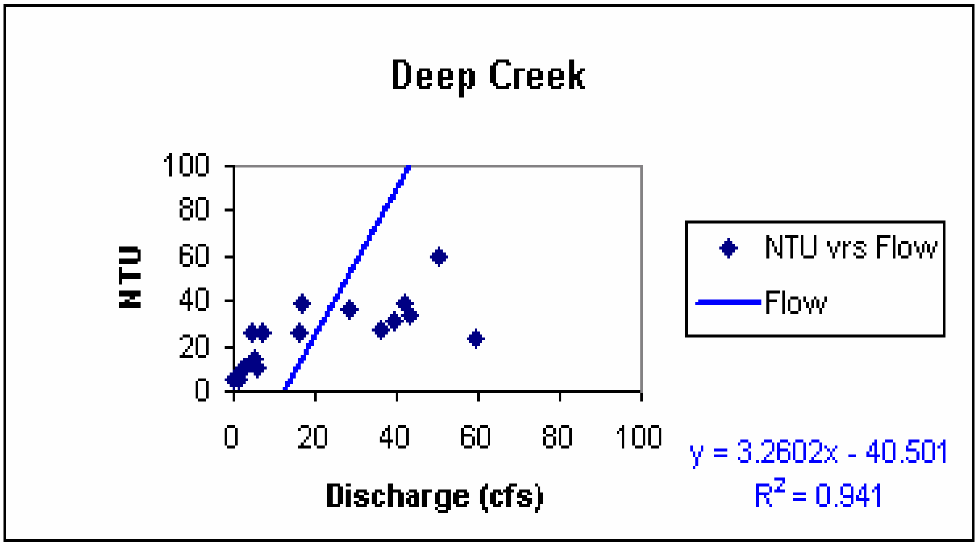
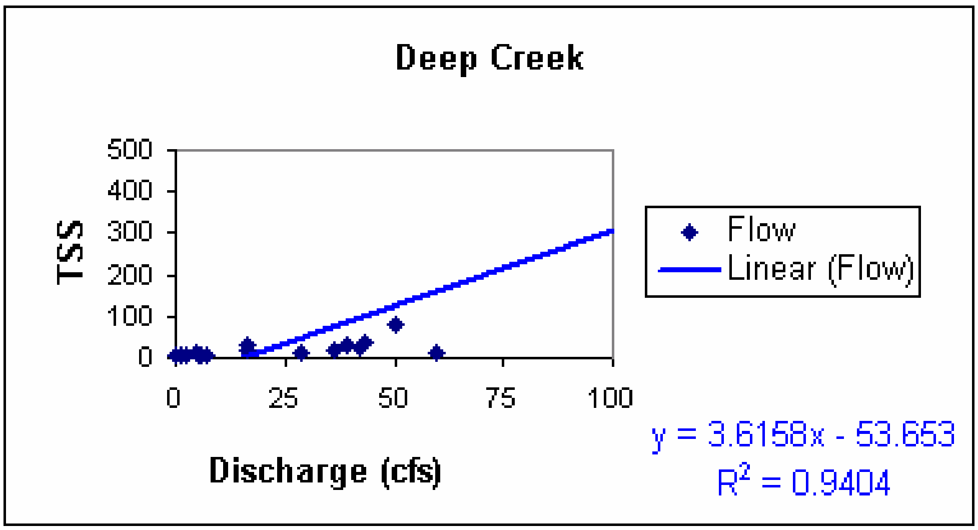
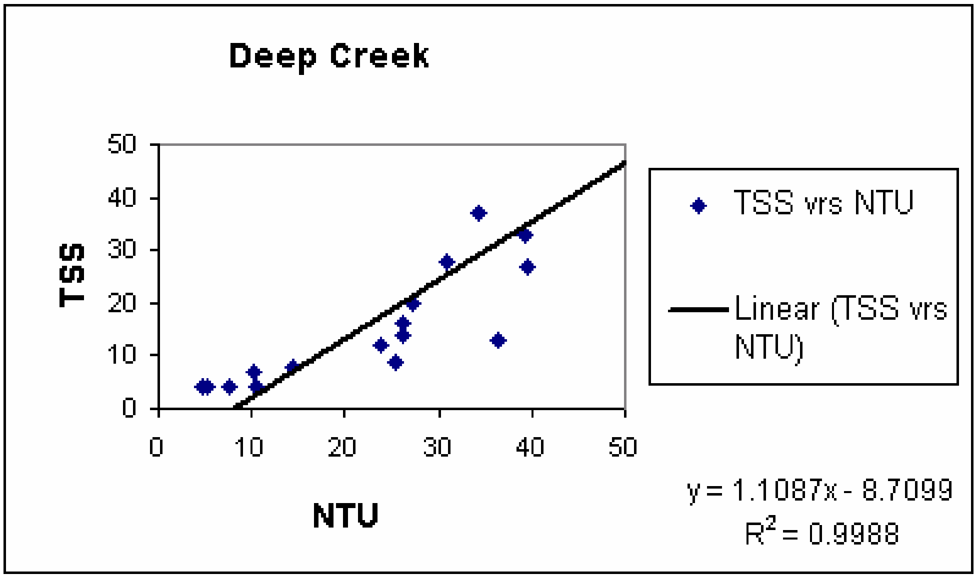
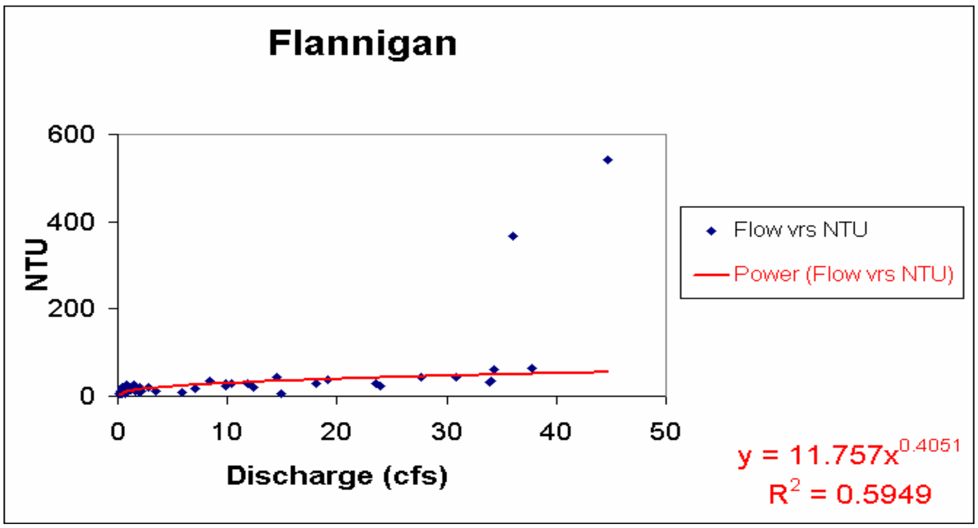
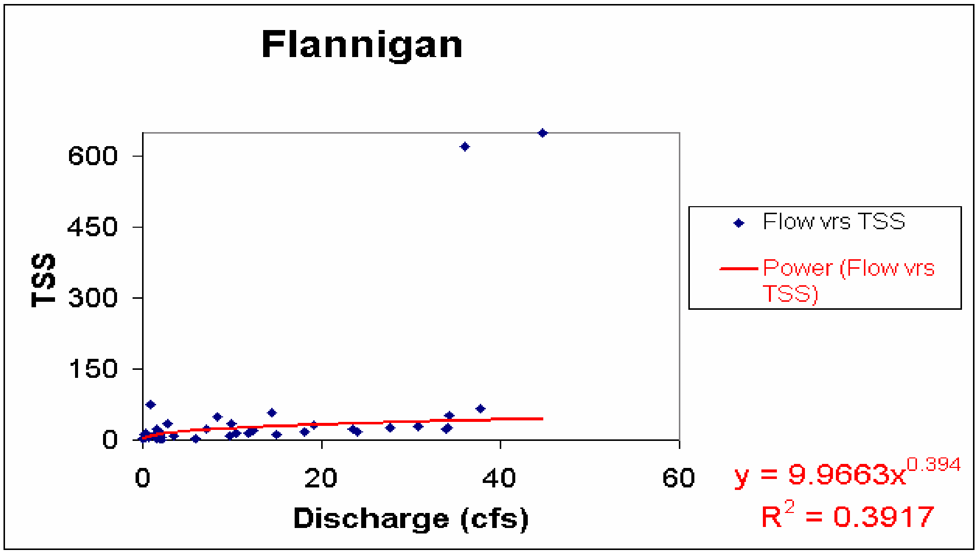
TSS
NTU vr TSS
Linear (NTU vr TSS)
y = 0.3992x + 8.5516
R^2 = 0.7801

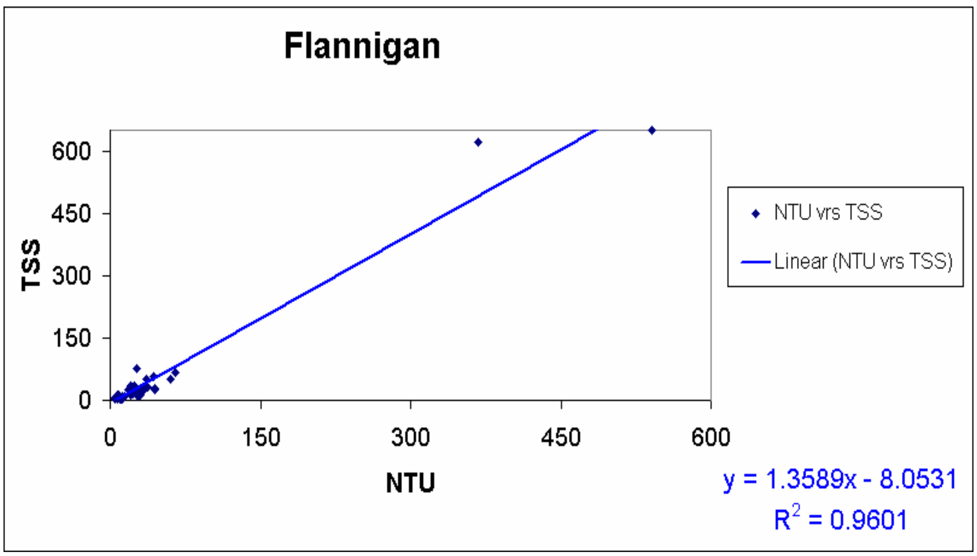

Deep Creek
NTU
100
80
60
40
20
0
0
20
40
60
80
100
Discharge (cfs)
NTU vrs Flow
Flow
y = 3.2602x - 40.501
R² = 0.941

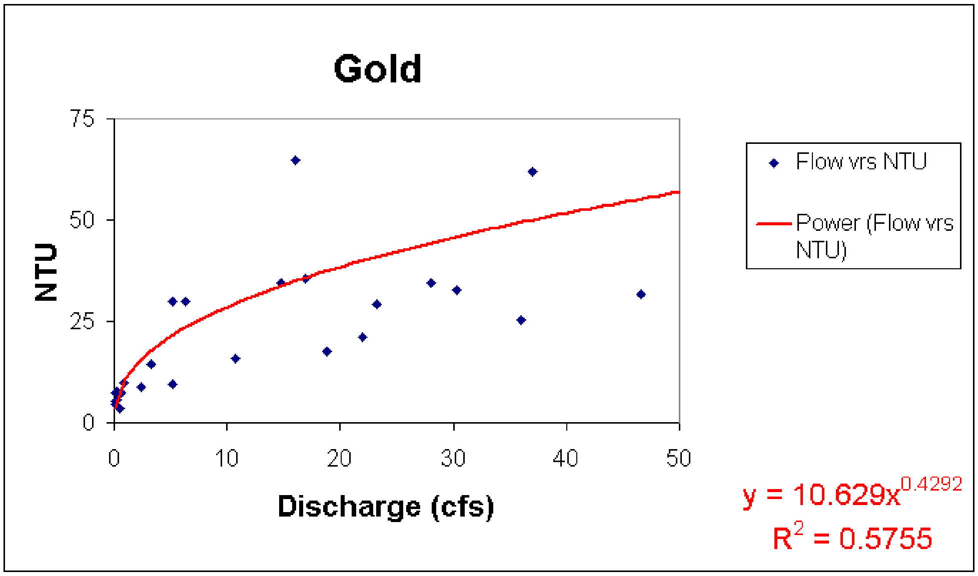

Deep Creek
TSS
500
400
300
200
100
0
0
25
50
75
100
Discharge (cfs)
Flow
Linear (Flow)
y = 3.6158x - 53.653
R² = 0.9404

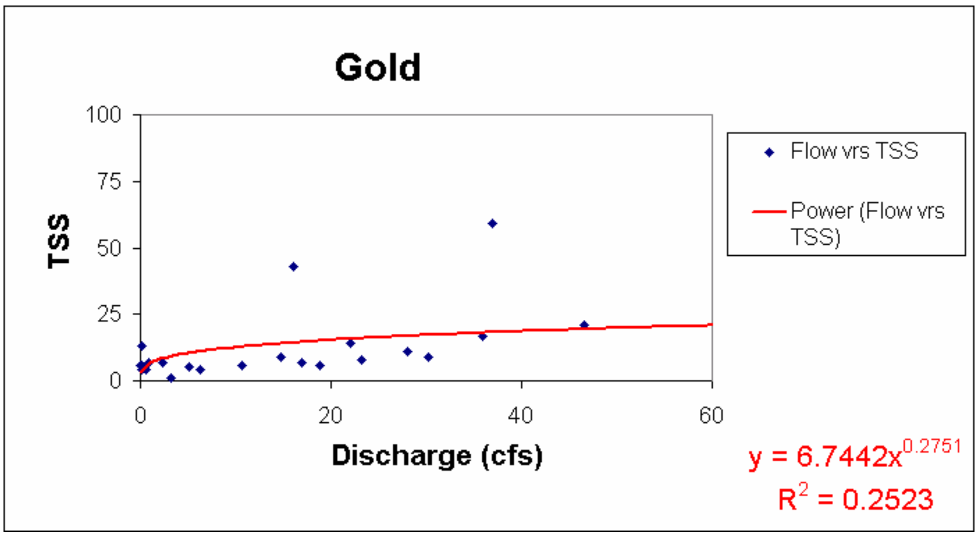

Deep Creek
TSS
50
40
30
20
10
0
0
10
20
30
40
50
NTU
TSS vrs NTU
Linear (TSS vrs NTU)
y = 1.1087x - 8.7099
R2 = 0.9988

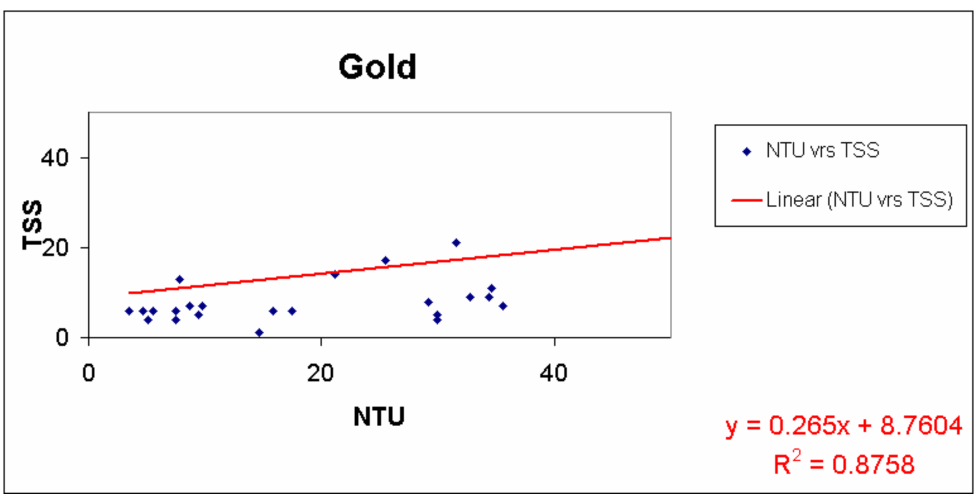

Flannigan
NTU
600
400
200
0
0
10
20
30
40
50
Discharge (cfs)
Flow vrs NTU
Power (Flow vrs NTU)
y = 11.757x0.4051
R2 = 0.5949

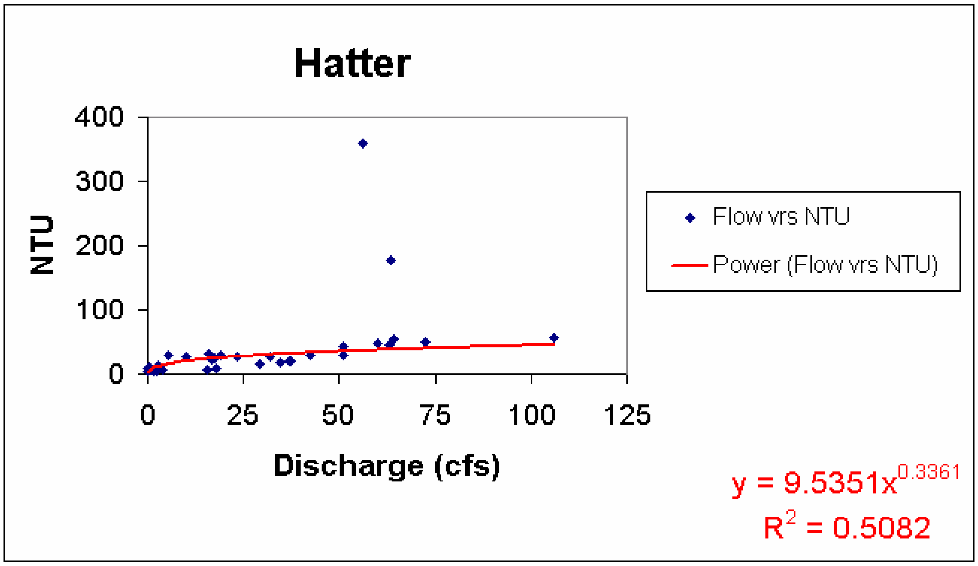

Flannigan
TSS
600
450
300
150
0
0
20
40
60
Discharge (cfs)
Flow vrs TSS
Power (Flow vrs TSS)
y = 9.9663x^0.394
R^2 = 0.3917

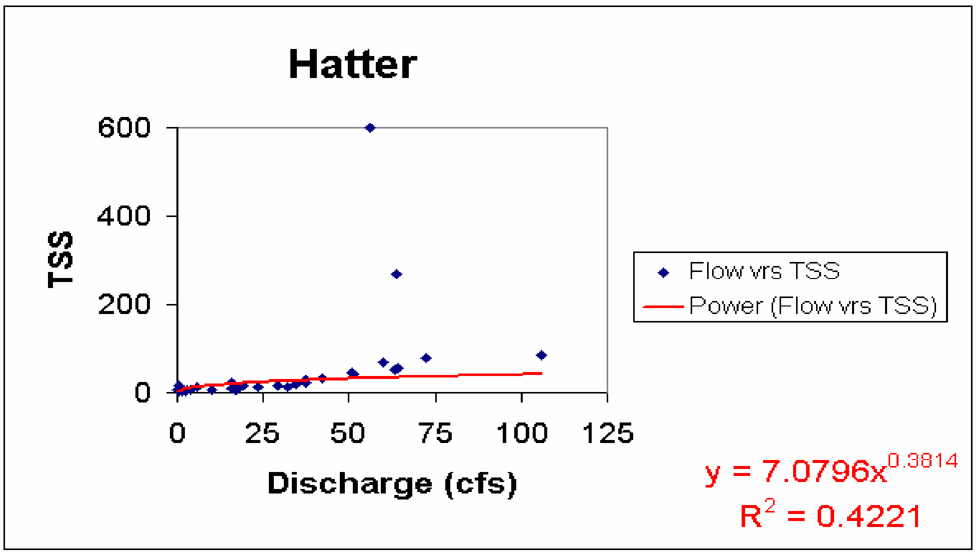

Flannigan
TSS
600
450
300
150
0
0
150
300
450
600
NTU
NTU vrs TSS
Linear (NTU vrs TSS)
y = 1.3589x - 8.0531
R^2 = 0.9601

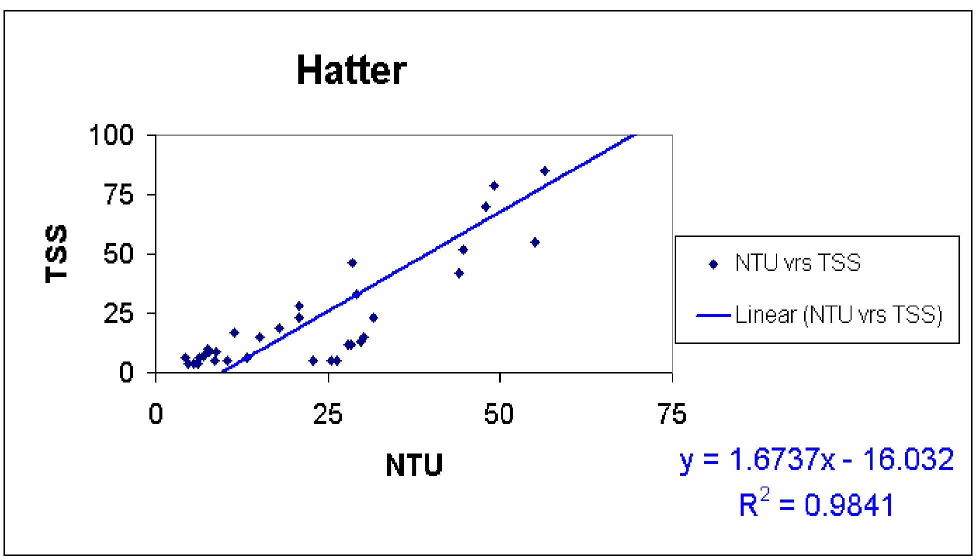

Gold
75
50
25
0
NTU
0
10
20
30
40
50
Discharge (cfs)
Flow vrs NTU
Power (Flow vrs NTU)
y = 10.629x^0.4292
R^2 = 0.5755

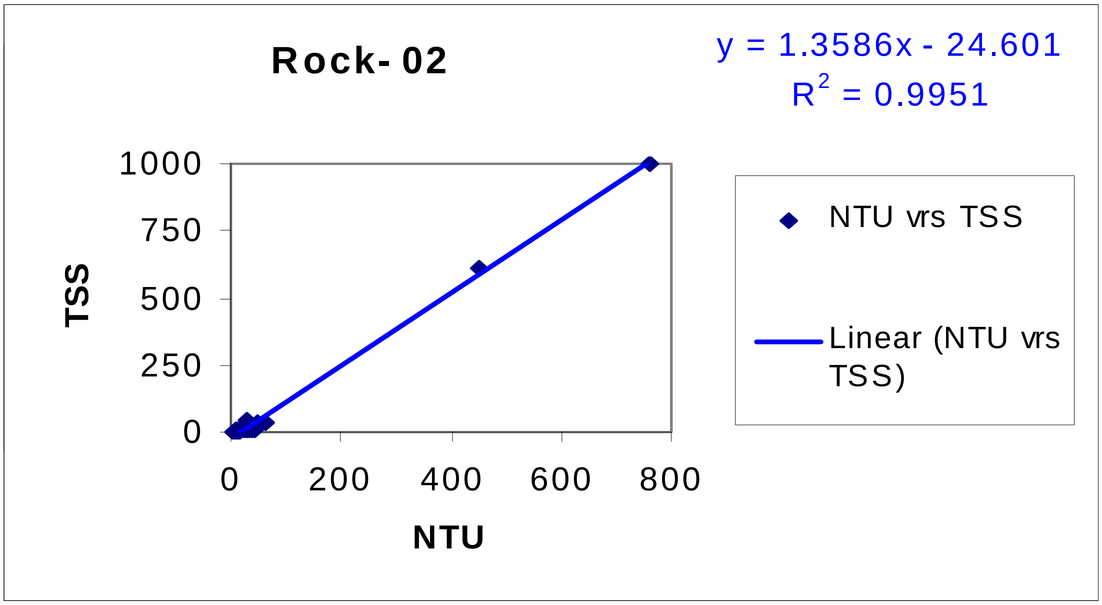

Gold
100
75
50
25
0
TSS
0
20
40
60
Discharge (cfs)
Flow vrs TSS
Power (Flow vrs TSS)
y = 6.7442x^0.2751
R^2 = 0.2523


Gold
40
20
0
TSS
0
20
40
NTU
NTU vrs TSS
Linear (NTU vrs TSS)
y = 0.265x + 8.7604
R^2 = 0.8758

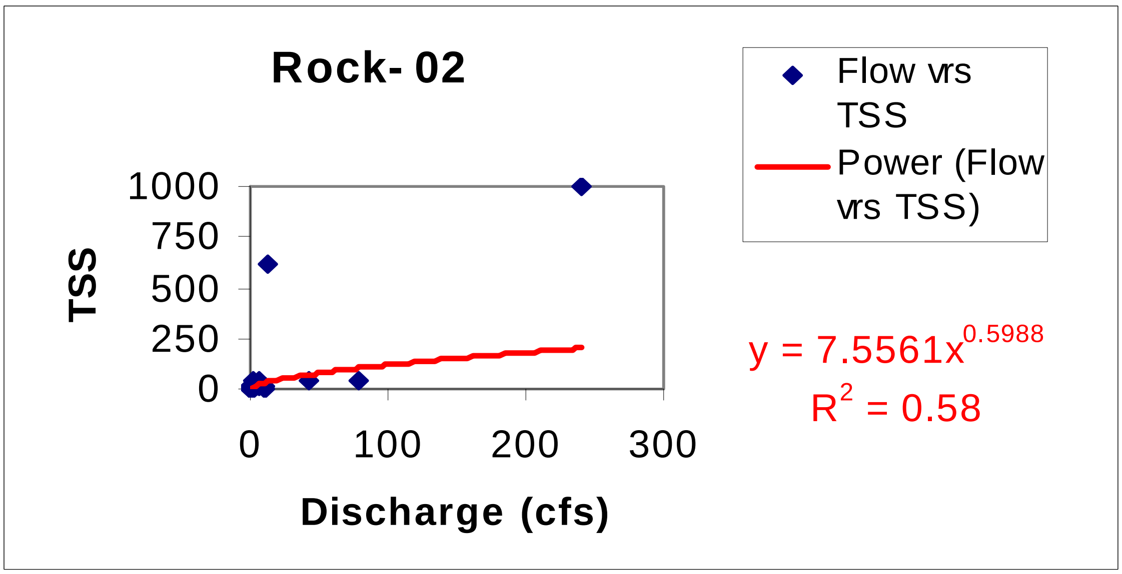

Hatter
400
300
200
100
0
NTU
0
25
50
75
100
125
Discharge (cfs)
Flow vrs NTU
Power (Flow vrs NTU)
y = 9.5351x^0.3361
R^2 = 0.5082


Hatter
600
400
200
0
TSS
0
25
50
75
100
125
Discharge (cfs)
Flow vrs TSS
Power (Flow vrs TSS)
y = 7.0796x^0.3814
R^2 = 0.4221

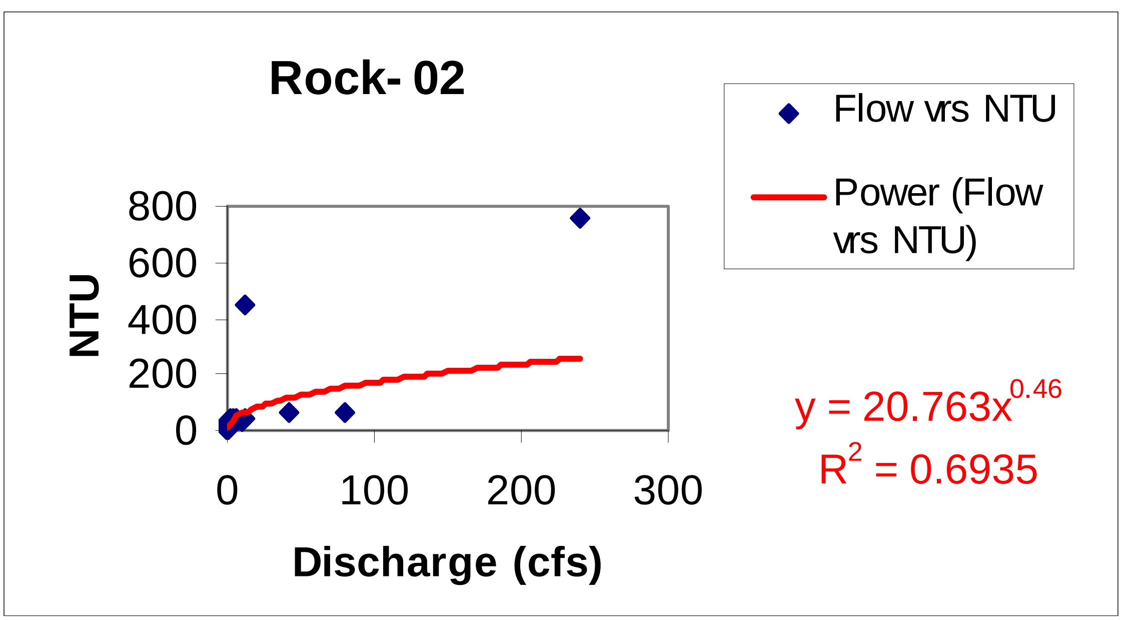

Hatter
100
75
50
25
0
TSS
0
25
50
75
NTU
NTU vrs TSS
Linear (NTU vrs TSS)
y = 1.6737x - 16.032
R^2 = 0.9841



Rock- 02
y = 1.3586x - 24.601
R2 = 0.9951
TSS
1000
750
500
250
0
0
200
400
600
800
NTU
NTU vrs TSS
Linear (NTU vrs TSS)



Rock- 02
Flow vrs TSS
Power (Flow vrs TSS)
TSS
1000
750
500
250
0
0
100
200
300
Discharge (cfs)
y = 7.5561x0.5988
R2 = 0.58



Rock- 02
Flow vrs NTU
Power (Flow vrs NTU)
NTU
800
600
400
200
0
0
100
200
300
Discharge (cfs)
y = 20.763x0.46
R2 = 0.6935

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Appendix C. Climate Data

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Table C-1. Climate data for stations in and around the Palouse River Subbasin.

Moscow Mountain, Idaho (16c02s), NRCS
Elevation = 4700 Feet
Period of Record = 1/1/2001 to 12/31/2002

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Mean Temperature (°F)	24.8	24.8	35.6	41.0	50.0	56.3	56.3	65.3	46.4	39.9	28.4	29.3	41.5
Avg. Max. Temperature (°F)	30.2	34.7	48.2	50.9	60.8	67.1	66.2	76.1	57.2	46.4	32.9	32.9	50.3
Avg. Min. Temperature (°F)	21.2	16.7	31.1	33.8	41.0	49.1	48.2	58.1	40.1	36.5	24.8	26.6	35.6
Avg. Total Precipitation (in.)	6.2	4.7	2.8	3.3	2.7	2.1	0.5	0.9	0.3	3.5	5.5	7.7	40.1
Avg. Number of days 90 (°F) and Above	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	3.0

Moscow U of I, Idaho (106152), Idaho State Climate Services
Elevation = 2660 Feet
Period of Record = 1/1/1971 to 12/31/2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Mean Temperature (°F)	29.4	34.1	40.1	46.5	53.3	59.2	65.5	66.4	58.7	48.3	36.5	29.6	47.3
Avg. Max. Temperature (°F)	35.6	41.3	49.0	57.5	65.9	73.1	82.6	84.0	74.4	60.5	43.1	35.5	58.5
Avg. Min. Temperature (°F)	23.2	26.8	31.2	35.4	40.6	45.2	48.4	48.7	42.9	36.0	29.9	23.6	36.0
Avg. Total Precipitation (in.)	3.0	2.5	2.6	2.5	2.6	1.9	1.1	1.2	1.3	2.0	3.5	3.1	27.4
Avg. Number of days 90 (°F) and Above	0.0	0.0	0.0	0.0	0.2	1.8	8.8	11.1	3.5	0.0	0.0	0.0	25.4

Potlatch 3 NNE, Idaho (107301), Idaho State Climate Services
Elevation = 2600 Feet
Period of Record = 1/1/1971 to 12/31/2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Mean Temperature (°F)	29.0	33.5	38.8	45.0	51.4	57.1	62.6	62.8	55.1	45.5	35.7	29.2	45.5
Avg. Max. Temperature (°F)	36.0	41.7	48.5	56.8	64.8	71.6	80.4	81.9	72.8	59.8	43.2	36.1	57.8
Avg. Min. Temperature (°F)	21.9	25.2	29.1	33.1	37.9	42.6	44.7	43.7	37.3	31.2	28.2	22.3	33.1
Avg. Total Precipitation (in.)	2.9	2.7	2.5	2.3	2.7	1.8	1.2	1.1	1.3	1.8	3.3	3.2	26.6
Avg. Number of days 90 (°F) and Above	0.0	0.0	0.0	0.0	0.0	0.5	4.3	5.4	1.0	0.0	0.0	0.0	11.2

Pullman 2 NW, Washington (456789) Western Regional Climate Center
Elevation = 2550 Feet
Period of Record = 1/1/1971 to 12/31/2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Mean Temperature (°F)	29.6	34.0	39.9	46.2	53.2	59.2	65.9	66.8	58.7	48.5	36.8	29.9	47.4
Avg. Max. Temperature (°F)	35.3	40.8	48.3	56.5	64.7	71.8	81.6	83.2	73.5	60.4	43.3	35.5	57.9
Avg. Min. Temperature (°F)	23.8	27.2	31.5	35.9	41.6	46.5	50.1	50.3	43.9	36.5	30.3	24.2	36.8
Avg. Total Precipitation (in.)	2.5	2.1	2.0	1.7	1.8	1.3	0.8	0.9	0.9	1.5	2.8	2.8	21.0
Avg. Number of days 90 (°F) and Above	0.0	0.0	0.0	0.0	0.2	2.2	9.8	11.9	3.5	0.0	0.0	0.0	27.6

Sherwin, Idaho (16c01s) Natural Resources Conservation Service
Elevation = 3200 ft (Lat 47.0Long 116.3)
Period of Record = 1/1/1971 to 12/31/2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Mean Temperature (°F)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Avg. Max. Temperature (°F)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Avg. Min. Temperature (°F)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Avg. Total Precipitation (in.)	5.6	4.6	4.0	3.0	3.2	2.4	1.4	1.4	1.8	3.0	5.7	6.1	42.2
Avg. Number of days 90 (°F) and Above	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Appendix D. Supplemental Sediment Data

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Supplemental Sediment Data

The sediment TMDLs are based on a stochastic flow model and actual data collected described within the Palouse Monitoring Plan (Appendix A). The sediment TMDLs give a gross yearly allocation and reduction for each stream, they do not necessarily identify sources of sediment pollution.

DEQ believes the three main anthropogenic sources of sediment pollution in the Palouse River Subbasin are erosion off the landscape above background levels (sheet and rill erosion), erosion from roads, and erosion occurring within the stream channel itself. DEQ has quantified amounts from each of these sources using specific models designed to describe and quantify sediment from each particular source. The Revised Universal Soil Loss Equation (RUSLE) was used to determine erosion off the landscape. The Water Erosion Prediction Project (WEPP)-Road module, an interface to the WEPP soil erosion model, was used to quantify erosion from roads. The National Resource Conservation Service (NRCS) field estimate procedure for channel erosion was conducted on all of the 303(d) listed streams to quantify instream channel erosion and describe stream characteristics and conditions. The methodology for each model is described in this appendix. The results calculated from each model are displayed in Table D-3. DEQ is providing this information as a possible starting point for implementation for landowners and the designated land management agencies. The data can then be compared to data collected in the future after implementation has taken place to see if and how much erosion from these sources has decreased as a result of BMP implementation. The data within this appendix is not the sediment TMDL, but supplemental sediment data.

RUSLE Data

The Revised Universal Soil Loss Equation (RUSLE) is a set of mathematical equations that estimate average annual soil loss and sediment yield resulting from interrill and rill erosion. It does not estimate erosion in channels or erosion from roads, it merely computes erosion from the soil surface. It is derived from the theory of erosion processes, with more than 10,000 plot-years of data from natural rainfall plots, and numerous rainfall-simulation plots. RUSLE is an exceptionally well-validated and documented equation. A strength of RUSLE is that it was developed by a group of nationally recognized scientists and soil conservationists who had considerable experience with erosional processes. RUSLE retains the structure of its predecessor, the Universal Soil Loss Equation (USLE).

RUSLE resulted from a 1985 workshop of government agency and university soil-erosion scientists. The workshop participants concluded that the USLE should be updated to incorporate the considerable amount of erosion information that had accumulated since the publication of Agriculture Handbook 537 (in 1978) and to specifically address the application of the USLE to land uses other than agriculture. This effort resulted in the computerized technology of RUSLE.

Current surface erosion rates and background surface erosion within this appendix were calculated using a GIS version of the RUSLE model. RUSLE is expressed as follows:

$$A = R * K * LS * C * P$$

Where
A = estimated average soil loss (tons per acre per year)
R = rainfall-runoff erosivity factor (feet*100*tonf*inch/acre/hour/year)
K = soil erodibility factor (tons*acre*hour/acre/100/feet/tonf/inch)
L = slope length factor (dimensionless)
S = slope steepness factor (dimensionless)
C = cover-management factor (dimensionless)
P = support practice factor (dimensionless)

The R factor is derived from the PRISM data.

The S and L factors are derived from the 10 DEMs using a set of equations developed by Boll and Brooks (2002).

The K factor was derived from the SSURGO data set for those parts of the Palouse River Subbasin covered by the SSURGO data set and from the STATSGO data set for the remainder.

The P factor was assigned a value of 0.84 for agricultural cropland, and 1.0 for all other land uses.

A land use map was developed for the project based on 1:24,000 scale county parcel maps, overlaid on NRCS digital orthophoto maps, and field verified in 2003, resulting in a 1:24,000 scale land use map of the Palouse River Subbasin.

The C factor (cropping factor) was developed in two ways: one for estimating natural background erosion rates, and the second for estimating current erosion rates based on the 2003 land use map. The C factor is the most critical component with the equation as different land, habitat, precipitation and vegetation types change the C factor.

Table D-1 lists the various soil mapping units within the Latah County Soil Survey (Barker 1979), with their associated mean annual precipitation and overstory habitat types.

Table D-1. Latah County Soil Survey mapping units with associated mean annual precipitation, habitat type overstory, and assigned C factor.

Soil Series	Precipitation	Habitat Type	C Factor
Latah Soil Survey	(inches)	(overstory)	(ground cover)
Athena	18	grass	0.0030
Bluesprin Flybow	18	grass	0.0030
Athena/Palouse	20	grass	0.0030
Bluesprin/Keuterville	21	grass/Ponderosa pine	0.0020

Garfield	21	grass(e)	0.0030
Latah*	21	grass	0.0060
Naff/Palouse	21	grass	0.0030
Naff/Thatuna	21	grass	0.0030
Palouse	21	grass	0.0030
Palouse/Latahco*	21	grass/Ponderosa pine	0.0040
Schumacher	21	grass	0.0030
Thatuna	21	grass	0.0030
Thatuna/Naff	21	grass	0.0030
Tilma/Garfield	21	grass	0.0030
Tilma/Naff	21	grass	0.0030
Tilma/Thatuna	21	grass	0.0030
Klickson/Bluesprin	22	Douglas fir/grass	0.0009
Latahco*	22	Ponderosa pine/shrubs	0.0020
Latahco/Lovell*	22	Ponderosa pine/shrubs	0.0020
Latahco/Thatuna*	22	Ponderosa pine/shrubs	0.0020
Lovell	22	Ponderosa pine	0.0010
Westlake/Latahco*	22	grass/ Ponderosa pine	0.0020
Driscoll/Larkin	23	Ponderosa pine	0.0010
Larkin	23	Ponderosa pine	0.0010
Southwick	23	Ponderosa pine	0.0010
Spokane	24	Douglas fir	0.0007
Hampson*	25	Douglas fir /shrubs(e)	0.0014
Joel	25	Douglas fir	0.0007
Klickson	25	Douglas fir	0.0007
Taney	25	Douglas fir	0.0007
Farber/Minaloosa	26	Douglas fir /grand fir	0.0005
Agatha	27	Douglas fir	0.0007
Crumarine*	28	grand fir /shrubs	0.0008
Minaloosa	28	grand fir	0.0004
Santa	28	grand fir	0.0004
Uvi	28	grand fir	0.0004
Uvi/Spokane	28	grand fir / Douglas fir	0.0005
Minaloosa/Huckleberry	30	grand fir /cedar	0.0003
Porrett*	30	hawthorn/sedge	0.0006

Huckleberry	32	cedar	0.0002
Molly	32	cedar	0.0002
Helmer	33	cedar	0.0002
Uvi/Vassar	36	grand fir /cedar	0.0005
Vassar	45	cedar	0.0002
Aquic xerofluvents*		shrubs	0.0014

* Indicates mapping units occurring as stream flood plains.

Background Erosion Rates

The C factors used to estimate natural background erosion rates using the RUSLE equation are shown in Table D-2. The C values used to determine background erosion rates are explained in this paragraph. The CNF has assigned background erosion rates to watersheds based on USFS research.

The CNF estimates that the background erosion rate for the West Fork Potlatch River is approximately 8 tons/mi^2/year. A C factor value of 0.0002 in the RUSLE model, and sediment routing using the Vanoni (1975) equation, results in a routed sedimentation rate of approximately 8 tons/mi^2/year. Such a C factor value is in the range of values reported for dense forests (Dechert 2004). For the prarie/grasslands, bunch grass was a natural vegetation dominant in the Palouse River Subbasin before major land use alterations. Assuming that bunch grasslands have a natural erosion rate somewhat similar to modern day hay land or grass lands, the C factor for grasslands within the Palouse River Subbasin is 0.003 (Dechert 2004).

Table D-2. Assignment of C factor values based on vegetation and precipitation.

Vegetation	Precipitation	C Factor
(overstory climax)	(inches)	
Grass	<=21	0.003
Ponderosa pine/grass	21-22	0.002
Ponderosa pine	22-23	0.001
Douglas fir/grass	22	0.0009
Douglas fir	25-27	0.0007
Grand fir/Douglas fir	26	0.0005
Grand fir	28	0.0004
Cedar/Grand fir	30	0.0003
Cedar	>30	0.0002

The asterisks in Table D-1 represent C factors that were doubled because the soil mapping units have greater erosional rates than other soil units. These mapping units have 1-3%

slopes, and occur within the floodplain along streams. These soil units are located in areas that have excessive stream channel meandering and repetitive precipitation events eroding these soils, more so than other soil mapping units. This in turn, increases the erosion potential for these units, therefore, the C factors were doubled to capture this phenomena (USDA 1997).

Estimating Surface Erosion Rates

Based on the land use map created by DEQ, C factors for current erosion rates were applied to the various land-uses in Table D-2. C factors were assigned based on reported values used in other modeling efforts, and assessment of the relative erosivity of the various land uses (Dechert 2004). The calculated background, detached, delivered erosion rates from the RUSLE model are presented by 303(d) watershed in Table D-3 (USDA 1997).

Table D-3. C factors assigned to the different land uses mapped in the Palouse River Subbasin.

Land Use	Precipitation	C Factor
(in 2003)	(inches)	
For (forestry)	38 +/- 5	0.0004
TS (timber/shrub)	27 +/- 3	0.0009
TG (timber/grass)	23 +/- 2	0.002
Grass (grasslands)	21 +/- 3	0.003
Meadow	36 +/- 5	0.006
CRP	29 +/- 2	0.006
Hay	31 +/- 3	0.009
Pasture	31 +/- 4	0.009
Grass Seed	29 +/- 2	0.009
Ag (2-yr rotation)	28 +/- 3	0.15
Ag (3-yr rotation)	25 +/- 3	0.1

Table D-4. Sediment results from RUSLE, WEPP, Channel Erosion.

	Big Cr Watershed	Deep Cr Watershed	Flannigan Cr Watershed	Gold Cr. Watershed	Hatter Cr Watershed	Rock Cr Watershed
Area (Acres)	10300.72	27315.56	18069.78	18069.78	16163.44	5174.76
Area (mi^2)	16.09	42.68	19.14	28.23	25.26	8.09
Background (tons/ac)	0.11	0.09	0.12	0.11	0.10	0.12
Background- (tons/mi^2)	72.96	58.05	79.55	71.17	66.18	74.50

Background Total (tons/yr)	1174.28	2477.52	1522.28	2009.36	1671.30	602.34
RUSLE detached (tons/ac)	0.17	2.73	2.89	3.09	0.58	1.39
RUSLE detached (tons/ mi^2)	107.07	1745.15	1852.54	1975.74	371.71	892.72
RUSLE detached Total (tons/yr)	1723.31	74484.08	35449.63	55783.22	9387.73	7218.27
RUSLE detached Backgrd (tons/yr)	549.03	72006.56	33927.35	53773.86	7716.43	7218.27
RUSLE Delivered (tons/yr)	163.06	18937.72	9838.93	14895.36	2186.32	2136.95
WEPP Delivered (tons/yr)	32.50	93.28	62.78	70.43	61.73	44.43
Channel Erosion NRCS (tons/yr)	8.92	398.23	177.06	162.12	218.99	24.88
Total model sources (tons/yr)	204.48	19429.23	10078.77	15127.91	2449.04	2206.26

Road Erosion

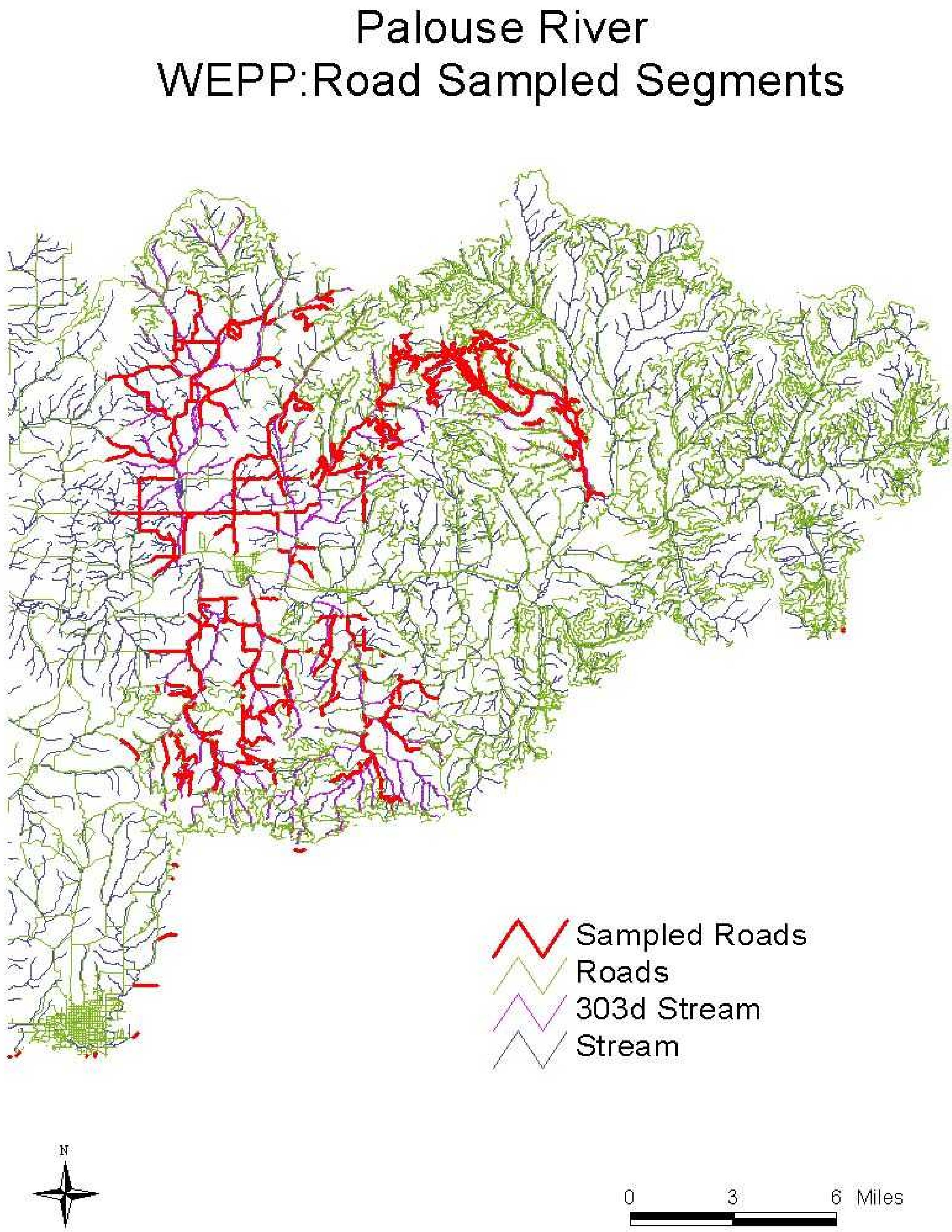
Based on field visits, discussion with land management agencies, reports and papers, and best professional judgment, erosion from roadways is significant in the Palouse subwatershed. To quantify these processes, the road analysis portion of the WEPP model was performed.

WEPP is a physically based soil erosion model that can provide estimates of soil erosion and sediment yield considering specific soil, climate, ground cover, and topographic conditions. It was developed by an interagency group of scientists, including the U.S. Department of Agriculture’s Agriculture Research Service (ARS), Forest Service and Natural Resources Conservation Service. and the U.S. Department of Interior's Bureau of Land Management and Geological Survey.

WEPP simulates the conditions that impact erosion - such as the amount of vegetation canopy, the surface residue, and the soil water content for every day in a multiple-year run. For each day that has a precipitation event, WEPP determines whether the event is rain or snow, and calculates the infiltration and runoff. If there is runoff, WEPP routes the runoff over the surface, calculating erosion or deposition rates for at least 100 points on the hillslope. It then calculates the average sediment yield from the hillslope.

WEPP-Road is an interface to the Water Erosion Prediction Project (WEPP) soil erosion model that allows users to easily describe numerous road erosion conditions and quantify erosion amounts. The WEPP-Road template has three overland flow elements: a road, a fillslope, and a forested buffer. The WEPP model allows a hillslope to be divided into segments with similar soils and vegetation called overland flow elements.

Roads in the Palouse were slowly driven in order to input geographically linked (GIS) information regarding the road and erosional conditions. Information like the type of road, surface of road, ditch information, cross-drain locations, buffer types and lengths to a stream channel with a bed and bank, and fillslope information were entered onto a Global Position System device (GPS). The information was downloaded into GIS for analysis. The data is arranged to show total sediment delivered to a waterbody within each 303(d) watershed and displayed in table D-3.



Map D-1. Palouse River WEPP:Road Sampled Segments

Channel Erosion

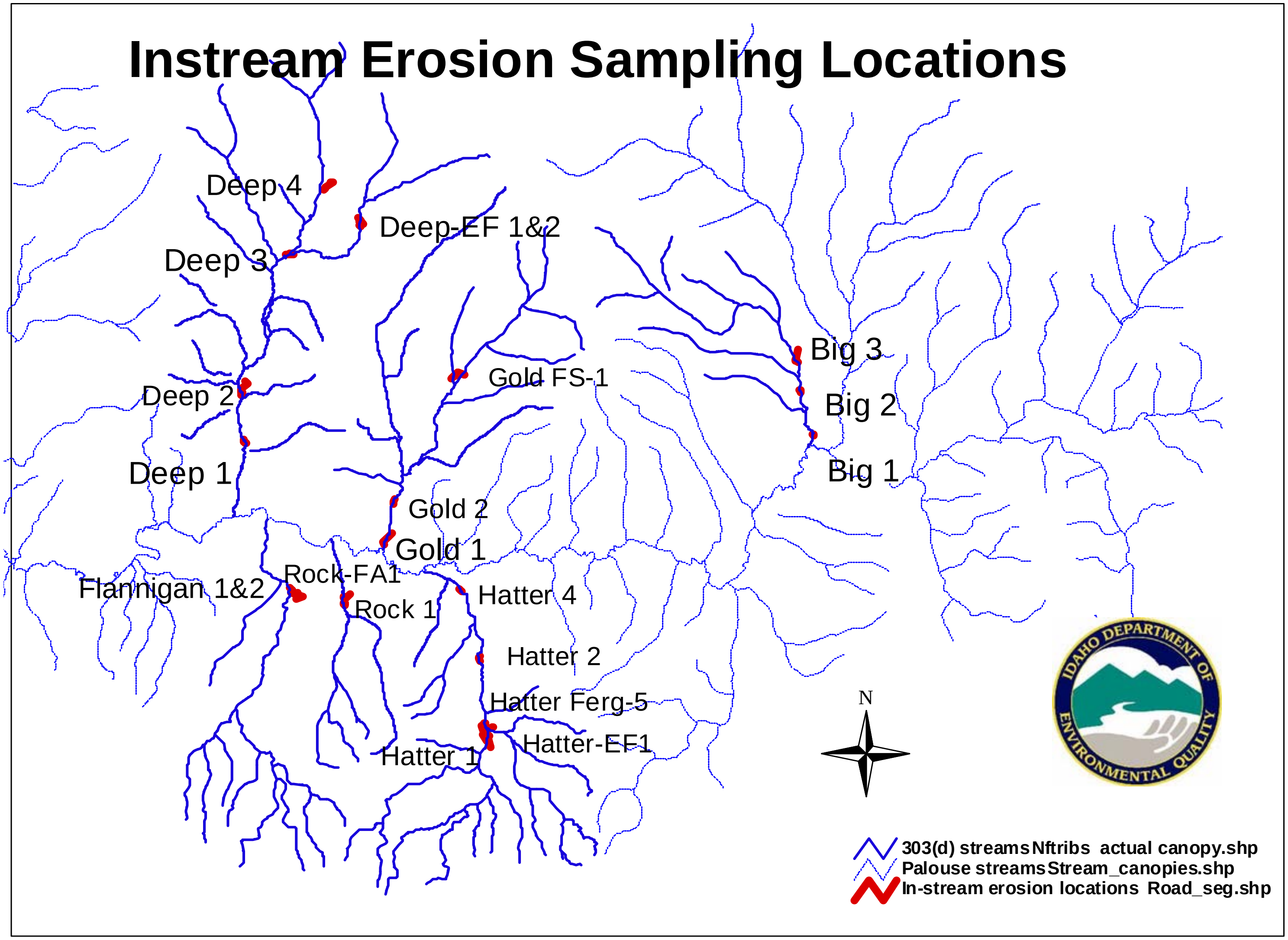
A significant amount of erosion occurs in the stream banks and all channels naturally erode to some degree. It is significant enough that several studies have attempted to quantify this phenomenon. For this TMDL, the National Resource Conservation Service (NRCS) field estimate procedure for channel erosion was conducted on all of the 303(d) listed streams to quantify instream channel erosion above natural conditions caused by anthropogenic effects. It has been proposed that a stream is in constant search of equilibrium and four forces control this equilibrium: sediment load, size of sediment particle, water quantity and slope of stream channel (NRCS 1983). These forces can be changed by natural and/or anthropogenic events.

Several sites were evaluated for each 303(d)-listed stream. Sites were selected based primarily on riparian and stream banks conditions and accessibility. Some sites that have significant amounts of erosion were not sampled because DEQ was not able to obtain access. In general the riparian areas along the entire length of each 303(d)-listed stream were grouped together based on their condition-good, fair or poor.

This judgment was used to describe the riparian and stream bank conditions for the entire stream. This very basic approach revealed that riparian areas with good conditions have no measurable amount of erosion above background while those with fair conditions have minimal amount of erosion above background and those with poor conditions have significant amounts of erosion above background. Therefore an attempt was made to sample the fair and poor reaches. The reach samples are shown on Map D-2.

Again this information is a good starting point and will provide a reference site for future analysis after implementation has began. At each site sampled, distances, stream widths, sinuosity, streambed particle size, and canopy observations were recorded.

In addition, a stream erosion condition inventory was completed. The stream erosion condition inventory describes the following factors: bank erosion evidence, bank stability condition, bank cover/vegetation, lateral channel stability, channel bottom stability and in-channel deposition. This inventory report was used to help determine the lateral recession rate. The total amount of sediment eroded from each reach was calculated using the above equation based on the field data (see Table D-3).



Map D-2. In-stream Erosion Sampling Locations.

Field Methods

The NRCS (1983) document outlines field methods used in this inventory. DEQ followed this methodology with the following exceptions. Additional data was collected to describe stream and riparian area conditions (see sample reach summary form and stream erosion condition inventory worksheet). The recession rate was determined for the entire reach rather than each eroding bank.

Within the sample reach, the field crews surveyed both right and left banks for eroding length and non-eroding length. Within a given sample reach, 100% of both banks were surveyed and documented on the field forms. The average annual lateral recession rate is the thickness of soil eroded from a bank surface (perpendicular to the face) in an average year. Recession rates are measured in feet per year. Channel erosion often occurs as “chunk” or “blowout” type erosion. A channel bank may not erode for a period of years when no major runoff events occur. When a major storm does occur, the bank may be cut back tens of feet for short distances. It is necessary to assign recession rates to banks with such processes in mind. When a bank is observed after a flood and ten feet of bank have been eroded, that ten feet must be averaged with the years when no erosion occurred. This will result in a much lower average annual lateral recession rate than a recession rate for one storm. The field crew estimated average annual recession rates by considering evidence of what had happened in the stream over the last 10 years and projecting what might happen in the stream over the next 10 years based on data and statistics of long term flows and extreme events (Dechert 2004).

The recession rate is critical to completing the calculations and a measurement was attempted in the field. On a few occasions the recession rate was modified in the office based on the scores on the scores of the stream erosion condition inventory worksheet.

Bank Erosion Calculations

The direct volume method is the procedure used to measure on-the-ground eroding bank surface area, coupled with estimates of recession rate and eroding bank particle size to calculate the total tons of eroding material over a given length of stream. The direct volume method is summarized in the following equation:

$$\frac{(eroding\ area)(lateral\ recession\ rate)(density)}{2000 lbs/ton} = E$$

E = erosion rate in tons/year

The eroding area is the product of the length of the eroding bank and the eroding bank height. Eroding bank length and bank heights were measured while walking along the stream channel. The eroding areas for all the eroding banks within a sample reach were summed and multiplied by the lateral recession rate for the sample reach to get the total volume of eroding bank material.

The following conversion rates were used to convert eroded bank material volume to eroded bank material weight in pounds. When eroding banks had significant differences in texture from top to bottom and the field crew recorded such, the texture volume-weights were calculated separately and summed.

Soil Texture	Volume-Weight (pounds/cubic foot)
Clay	60-70
Silt	75-90
Sand	90-110
Gravel	110-120
Loam	80-100
Sandy loam	90-110
Gravelly loam	110-120
Very gravelly sands/loams	120-130
Cobbles, boulders, etc.	120-130

STREAM EROSION CONDITION INVENTORY WORKSHEET

Stream Name____Reach Number________________________
Left or Right Bank (circle)
Average Bank Height___________________Sample Length_____________________________________
Non-Eroding Length___________________________Bank Material Classes (see reverse side)___________

RATED FACTORS	RATING
1. BANK EROSION EVIDENCE	
Does not appear to be eroding	0
Erosion evident	1
Surface of bank eroding and top of bank has cracking present	2
Slumps and clumps sloughing off into stream (SIZE)	3
2. BANK STABILITY CONDITION (Ability to withstand erosion from streamflows)	
Very little unprotected bank, no undercut vegetation, **AND/OR** bank materials non-erosive	0
Predominantly bare and unprotected, some rills, moderate undercut vegetation	1
Almost completely bare, unprotected bank, rills, severely undercut vegetation, exposed roots	2
Bare, numerous rills/gullies, very severely undercut vegetation, falling trees and/or fences	3
3. BANK COVER/VEGETATION	
Predominantly covered with perennials **AND/OR** stable rock/bedrock	0
40% or less bare/erodible, **AND/OR** cover is annual and perennials mixed	1
40% to 70% bare/erodible, **AND/OR** cover is mostly annual vegetation	2
Predominantly bare and erodible/no cover	3
4. LATERAL CHANNEL STABILITY	
No evidence of significant lateral movement of channel	0
Active lateral movement of channel	1
5. CHANNEL BOTTOM STABILITY	
Channel in bedrock **OR** not eroding (Stable)	0
Minor channel bed degradation/downcutting	1
Significant evidence of downcutting, active headcuts	2
6. IN-CHANNEL DEPOSITION	
No evidence of recent deposition (includes all sizes of bedload type materials)	0
Mobile material in recent deposition, deposits will probably move down channel in next high flow	1
Deposition is stable **AND/OR** vegetated (more than this growing season) channel is aggrading	-1

TOTAL________

Factors contributing to erosion (concentrated flows, animal access-trampling, grazing impacts to vegetation, fire return flows, roads, bridges, culverts)____

____

____

Other notes____

____

____

____

(Over)

Bank Material Classes

(Circle best Choice/s)

Soil Classes

<15% coarse fragments, just use the fine soil class
(15-35%) Gravelly (gr), Cobbley (co), Bouldery (b)
(35-60%) Very gravelly (vgr), very cobbley (vco), very bouldery (vb)
(>60%) Extremely gravelly (exgr) extremely cobbley (exco), extremely bouldery (exbo)

sand – sa
sandy loam – sal
loamy sand – lsa
clayey sand – csa
silt – si
loamy silt – lsi
silt loam – sil
clayey silt – csi
loam – l
clay – c
loamy clay – lc
sandy clay – sac
silty clay – sic

Notes____

SAMPLE REACH SUMMARY FORM

Stream Name ____
Reach Number____
Hydrological Unit____________________________________
GPS Coordinate: Start_________________________________
End_________________________________
WBID____
Rosgen Channel Type _________________________________
Slope/Gradient_______________________________________
Bank Full Width______________________________________
Bank Full Depth______________________________________
Floodplain Width_____________________________________
Average Wetted Width (ft.)_____________________________
Average Wetted Depth (ft.) ____________________________
Average Surface Velocity (ft/sec)________________________
Sinuosity____
Dominant Particle Size_________________________________
Adjacent Land Use____________________________________
Canopy Shade Height (ft.)______________________________
Canopy Shade Crown Width (ft.)_________________________
Canopy Offset (from waters edge) (ft.)____________________
Canopy Density
Topographic Altitude: Rt.______________ & Lft.____________
Mannings "n"____
Recession Rate (Field Estimate)_____________________________________

Field Crew____

Canopy Density Examples

Open Pine	65%	
Closed Pine	75%	X % Covered
Tight Spruce/Fir	85%	
Dense Emergent Vegetation	90%	

Bed Particle Size

Clay	.001
Silt	.004 to .06 .03 median
Sand	.06 (Fine) to 2mm
Gravel	4mm (Pea Size) to 64mm (tennis Ball size)
Cobble	> 64mm to 250mm (Volleyball size)
Boulder	> 250mm
Bedrock	

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Appendix E. Temperature Cover Analysis

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This appendix list for each stream segment, the soil map unit number, the potential cover determined for each soil unit, the existing cover interpreted from aerial photos, and the difference between the two covers. Data are in order from the downstream end of the segment (usually the mouth) to the upstream end (usually the headwaters). The difference between the two covers is calculated by subtracting the potential cover from the existing cover, dividing the result by the potential cover, and converting to a percentage. The result reflects the difference between the two covers with a negative representing existing covers less than potential and a positive shows existing covers greater than potential. In some cases soils were not known, but were estimated based on surrounding watershed patterns. These soil units are marked with an “*”. Map E-1 displays the existing canopy cover for each of the stream segments with landownership. Map E-2 displays the deficit cover in percentage and in condition classes with landownership.

Riparian Vegetative Cover Analysis for Flannigan Creek

Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
Lower Flannigan Creek (AU# ID17060108CL011b_03)				
11	50	40	Good	-20
27	70	30	Poor	-57
27	70	50	Fair	-29
27	70	30	Poor	-57
27	70	10	Poor	-86
27	70	20	Poor	-71
27	70	50	Fair	-29
27	70	60	Good	-14
27	70	70	Very Good	0
7	70	70	Very Good	0
Average	**68**	**43**	**Fair**	**-36.3**
Upper Flannigan Creek (AU# ID17060108CL011a_03)				
38	50	70	Very Good	40
38	50	60	Very Good	20
38	50	50	Very Good	0
38	50	70	Very Good	40
38	50	60	Very Good	20
38	50	30	Fair	-40
38	50	20	Poor	-60
38	50	30	Fair	-40
38	50	60	Very Good	20
38	50	70	Very Good	40
61	90	90	Very Good	0
64	90	90	Very Good	0
Average	**56.7**	**58.3**	**Very Good**	**3.33**
First Tributary to Lower Flannigan Creek (AU# ID17060108CL011b_02)				
27	70	50	Fair	-29
27	70	30	Poor	-57

27	70	20	Poor	-71
27	70	50	Fair	-29
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
27	70	30	Poor	-57
27	70	10	Poor	-86
27	70	60	Good	-14
Average	**70**	**35.7**	**Poor**	**-49**
First Tributary to Upper Flannigan Creek (AU# ID17060108CL011a_02)				
38	50	50	Very Good	0
38	50	70	Very Good	40
61	90	70	Fair	-22
61	90	80	Good	-11
64	90	80	Good	-11
64	90	90	Very Good	0
Average	**76.7**	**73.3**	**Good**	**-0.67**
Second Tributary to Upper Flannigan Creek (AU# ID17060108CL011a_02)				
38	50	70	Very Good	40
38	50	30	Fair	-40
38	50	70	Very Good	40
East Fork				
61	90	80	Good	-11
64	90	90	Very Good	0
48	70	90	Very Good	29
64	90	90	Very Good	0
West Fork				
61	90	80	Good	-11
61	90	90	Very Good	0
64	90	90	Very Good	0
Average	**76**	**78**	**Very Good**	**4.7**
Third Tributary to Upper Flannigan Creek (AU# ID17060108CL011a_02)				
38	50	30	Fair	-40
38	50	70	Very Good	40
61	90	70	Fair	-22
61	90	80	Good	-11
64	90	80	Good	-11
64	90	90	Very Good	0
Average	**76.7**	**70**	**Good**	**-7.33**
West Fork Flannigan Creek (AU# ID17060108CL011a_02)				
38	50	50	Very Good	0
38	50	70	Very Good	40
38	50	60	Very Good	20
38	50	60	Very Good	20
38	50	30	Fair	-40
38	50	70	Very Good	40

40	80	70	Good	-12.5
61	90	80	Good	-11
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
61	90	70	Fair	-22
Average	**62.2**	**62.2**	**Very Good**	**3.8**

First Tributary to West Fork Flannigan Creek (AU# ID17060108CL011a_02)				
40	80	80	Very Good	0
60	80	70	Good	-12.5
60	80	70	Good	-12.5
60	80	80	Very Good	0
Average	**80**	**75**	**Good**	**-6.3**
Second Tributary to West Fork Flannigan Creek (AU# ID17060108CL011a_02)				
40	80	70	Good	-12.5
61	90	70	Fair	-22
61	90	80	Good	-11
64	90	80	Good	-11
Average	**87.5**	**75**	**Good**	**-14.1**

Riparian Vegetative Cover Analysis for Hatter Creek

Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
Lower Hatter Creek (AU# ID17060108CL015b_03)				
11	50	30	Fair	-40
26	70	40	Poor	-43
38	50	50	Very Good	0
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
38	50	60	Very Good	20
38	50	30	Fair	-40
38	50	20	Poor	-60
7	70	10	Poor	-86
7	70	50	Fair	-29
7	70	60	Good	-14
7	70	50	Fair	-29
7	70	60	Good	-14
7	70	40	Poor	-43
7	70	30	Poor	-57
7	70	10	Poor	-86
7	70	40	Poor	-43
Average	**63.3**	**38.7**	**Fair**	**-37.6**
First Tributary to Lower Hatter Creek (AU# ID17060108CL015b_02)				
11	50	10	Poor	-80
26	70	10	Poor	-86

26	70	60	Good	-14
26	70	10	Poor	-86
26	70	50	Fair	-29
26	70	60	Good	-14
27	70	50	Fair	-29
27	70	70	Very Good	0
40	80	70	Good	-12.5
40	80	80	Very Good	0
Average	**70**	**47**	**Fair**	**-35.1**
Second Tributary to Lower Hatter Creek (AU# ID17060108CL015b_02)				
38	50	10	Poor	-80
38	50	70	Very Good	40
38	50	10	Poor	-80
40	80	70	Good	-12.5
9	70	70	Very Good	0
7	70	50	Fair	-29
40	80	30	Poor	-62.5
40	80	60	Fair	-25
41	80	60	Fair	-25
58	80	90	Very Good	12.5
41	80	90	Very Good	12.5
41	80	80	Very Good	0
61	90	80	Good	-11
Average	**72.3**	**59.2**	**Good**	**-20**
Third Tributary to Lower Hatter Creek (AU# ID17060108CL015b_02)				
7	70	70	Very Good	0
40	80	70	Good	-12.5
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
40	80	60	Fair	-25
40	80	50	Fair	-37.5
40	80	30	Poor	-62.5
41	80	60	Fair	-25
41	80	70	Good	-12.5
Average	**78.6**	**58.6**	**Fair**	**-25**
Fourth Tributary Complex to Lower Hatter Creek (AU# ID17060108CL015b_02)				
7	70	50	Fair	-29
48	70	50	Fair	-29
48	70	70	Very Good	0
40	80	70	Good	-12.5
40	80	50	Fair	-37.5
40	80	60	Fair	-25
40	80	70	Good	-12.5
41	80	70	Good	-12.5
41	80	80	Very Good	0

7	70	60	Good	-14
7	70	50	Fair	-29
40	80	50	Fair	-37.5
40	80	60	Fair	-25
49	70	60	Good	-14
7	70	70	Very Good	0
40	80	70	Good	-12.5
41	80	70	Good	-12.5
41	80	40	Poor	-50
41	80	70	Good	-12.5
7	70	60	Good	-14
7	70	70	Very Good	0
7	70	60	Good	-14
7	70	70	Very Good	0
59	80	70	Good	-12.5
59	80	40	Poor	-50
64	90	70	Fair	-22
63	90	80	Good	-11
64	90	80	Good	-11
63	90	80	Good	-11
7	70	60	Good	-14
7	70	70	Very Good	0
64	90	70	Fair	-22
64	90	80	Good	-11
Average	**77.9**	**64.5**	**Good**	**-16.9**
Fifth Tributary to Lower Hatter Creek (AU# ID17060108CL015b_02)				
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
7	70	50	Fair	-29
7	70	60	Good	-14
40	80	60	Fair	-25
40	80	40	Poor	-50
40	80	60	Fair	-25
40	80	70	Good	-12.5
59	80	70	Good	-12.5
Average	**77.1**	**58.6**	**Fair**	**-24**
Upper Hatter Creek and Tributaries (AU# ID17060108CL015a_02)				
7	70	50	Fair	-29
60	80	70	Good	-12.5
59	80	70	Good	-12.5
59	80	40	Poor	-50
59	80	50	Fair	-37.5
59	80	70	Good	-12.5
63	90	70	Fair	-22

63	90	80	Good	-11
64	90	80	Good	-11
64	90	90	Very Good	0
63	90	70	Fair	-22
59	80	40	Poor	-50
59	80	70	Good	-12.5
59	80	80	Very Good	0
64	90	80	Good	-11
59	80	80	Very Good	0
59	80	70	Good	-12.5
59	80	80	Very Good	0
64	90	90	Very Good	0
59	80	80	Very Good	0
59	80	70	Good	-12.5
64	90	70	Fair	-22
64	90	80	Good	-11
59	80	70	Good	-12.5
64	90	80	Good	-11
64	90	70	Fair	-22
64	90	90	Very Good	0
63	90	90	Very Good	0
Average	**84.3**	**72.5**	**Good**	**-14.2**
Long Creek (AU# ID17060108CL015a_02)				
7	70	50	Fair	-29
7	70	60	Good	-14
58	80	70	Good	-12.5
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
58	80	60	Fair	-25
61	90	60	Fair	-33.3
61	90	70	Fair	-22
64	90	60	Fair	-33.3
64	90	70	Fair	-22
64	90	80	Good	-11
64	90	90	Very Good	0
64	90	70	Fair	-22
63	90	70	Fair	-22
64	90	70	Fair	-22
64	90	80	Good	-11
Average	**85.7**	**68.6**	**Good**	**-19.9**

Riparian Vegetative Cover Analysis for Gold Creek Watershed.

Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**

Lower Gold Creek and Lowest Tributary (AU# ID17060108CL029_03)				
11	50	10	Poor	-80
11	50	20	Poor	-60
11	50	30	Fair	-40
26	70	30	Poor	-57
50	70	30	Poor	-57
28	70	20	Poor	-71
Average	**60**	**23.3**	**Poor**	**-60.8**
Upper Gold Creek (AU# ID17060108CL030_02)				
26	70	40	Poor	-43
27	70	40	Poor	-43
27	70	50	Fair	-29
38	50	50	Very Good	0
38	50	60	Very Good	20
38*	50	50	Very Good	0
38*	50	60	Very Good	20
7*	70	70	Very Good	0
7*	70	80	Very Good	14
7*	70	70	Very Good	0
31*	80	80	Very Good	0
63*	90	90	Very Good	0
63*	90	80	Good	-11
Average	**67.7**	**63.1**	**Good**	**-5.5**
Nelson Creek (AU# ID17060108CL030_02)				
27	70	30	Poor	-57
38	50	70	Very Good	40
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
38	50	60	Very Good	20
38	50	70	Very Good	40
40	80	80	Very Good	0
30	80	70	Good	-12.5
30	80	80	Very Good	0
63	90	80	Good	-11
63*	90	90	Very Good	0
Average	**71.1**	**70**	**Very Good**	**2.2**
First Unnamed Tributary to Upper Gold Creek (AU# ID17060108CL030_02)				
7*	70	40	Poor	-43
7*	70	70	Very Good	0
30*	80	80	Very Good	0
30*	80	50	Fair	-37.5
64*	90	90	Very Good	0
Average	**78**	**66**	**Good**	**-16.1**
Waterhole Creek (AU# ID17060108CL030_02)				
7*	70	70	Very Good	0

30-31*	80	80	Very Good	0
Average	**75**	**75**	**Very Good**	**0**
Second Unnamed Tributary to Upper Gold Creek (AU# ID17060108CL030_02)				
30-31*	80	80	Very Good	0
30-31*	80	80	Very Good	0
30-31*	80	60	Fair	-25
30-31*	80	80	Very Good	0
30-31*	80	70	Good	-12.5
30-31*	80	80	Very Good	0
Average	**80**	**75**	**Good**	**-6.25**
Upper Most Tributaries (2) to Upper Gold Creek (AU# ID17060108CL030_02)				
30-31*	80	80	Very Good	0
30-31*	80	80	Very Good	0
63*	90	90	Very Good	0
Average	**83.3**	**83.3**	**Very Good**	**0**
Lower Crane Creek (AU# ID17060108CL031b_02)				
26	70	30	Poor	-57
26	70	40	Poor	-43
26	70	60	Good	-14
26	70	70	Very Good	0
7	70	80	Very Good	14
7	70	50	Fair	-29
Average	**70**	**55**	**Fair**	**-21.5**
Tributaries (3) to Lower Crane Creek (AU# ID17060108CL031b_02)				
28	70	20	Poor	-71
28	70	20	Poor	-71
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
26	70	30	Poor	-57
5	50	50	Very Good	0
27	70	40	Poor	-43
27	70	20	Poor	-71
39	80	50	Fair	-37.5
39	80	20	Poor	-75
Average	**70**	**31.3**	**Poor**	**-53.2**
Upper Crane Creek (AU# ID17060108CL031a_02)				
7	70	60	Good	-14
7	70	70	Very Good	0
30-31*	80	80	Very Good	0
30-31*	80	70	Good	-12.5
30-31*	80	80	Very Good	0
Average	**76**	**72**	**Good**	**-5.3**

Riparian Vegetative Cover Analysis for Big Creek Watershed.

Soil #	Potential Cover %	Existing Cover %	Cover Condition Class	E – P / P * 100 (%)
Lower Big Creek (AU# ID17060108CL027b_02)				
7	70	50	Fair	-29
7	70	70	Very Good	0
7	70	60	Good	-14
7	70	70	Very Good	0
7*	70	60	Good	-14
7*	70	60	Good	-14
7*	70	60	Good	-14
7*	70	60	Good	-14
7*	70	20	Poor	-71
Average	**70**	**56.7**	**Good**	**-18.9**
Lost Creek (AU# ID17060108CL027b_02)				
7	70	70	Very Good	0
7	70	60	Good	-14
30	80	60	Fair	-25
Average	**73.3**	**63.3**	**Good**	**-13**
Last Chance Creek (AU# ID17060108CL027b_02)				
7	70	70	Very Good	0
63	90	90	Very Good	0
Average	**80**	**80**	**Very Good**	**0**
Two Unnamed Tributaries to Lower Big Creek (AU# ID17060108CL027b_02)				
7*	70	60	Good	-14
7*	70	60	Good	-14
7*	70	70	Very Good	0
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
7*	70	60	Good	-14
7*	70	60	Good	-14
30*	80	60	Fair	-25
Average	**71.7**	**61.7**	**Good**	**-13.5**
Upper Big Creek (AU# ID17060108CL027a_02)				
7*	70	70	Very Good	0
30*	80	80	Very Good	0
30*	80	80	Very Good	0
63*	90	90	Very Good	0
Average	**80**	**80**	**Very Good**	**0**
Two Unnamed Tributaries to Upper Big Creek (AU# ID17060108CL027a_02)				
30*	80	80	Very Good	0
30*	80	70	Good	-12.5
30*	80	80	Very Good	0
30*	80	50	Fair	-37.5
30*	80	70	Good	-12.5

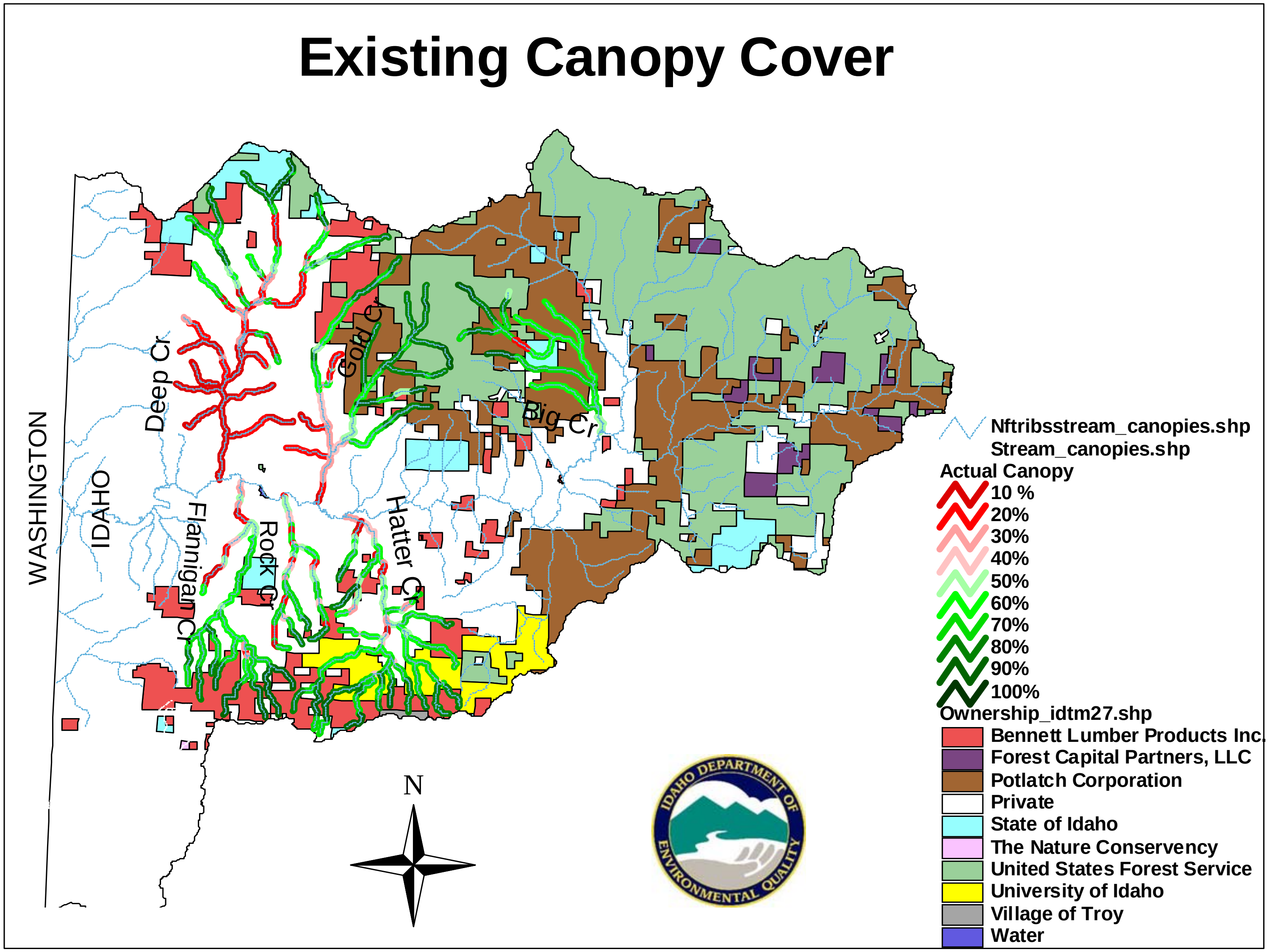
30*	80	80	Very Good	0
63*	90	90	Very Good	0
63*	90	70	Fair	-22
Average	**82.5**	**73.75**	**Good**	**-10.6**

Riparian Vegetative Cover Analysis for Deep Creek Watershed.

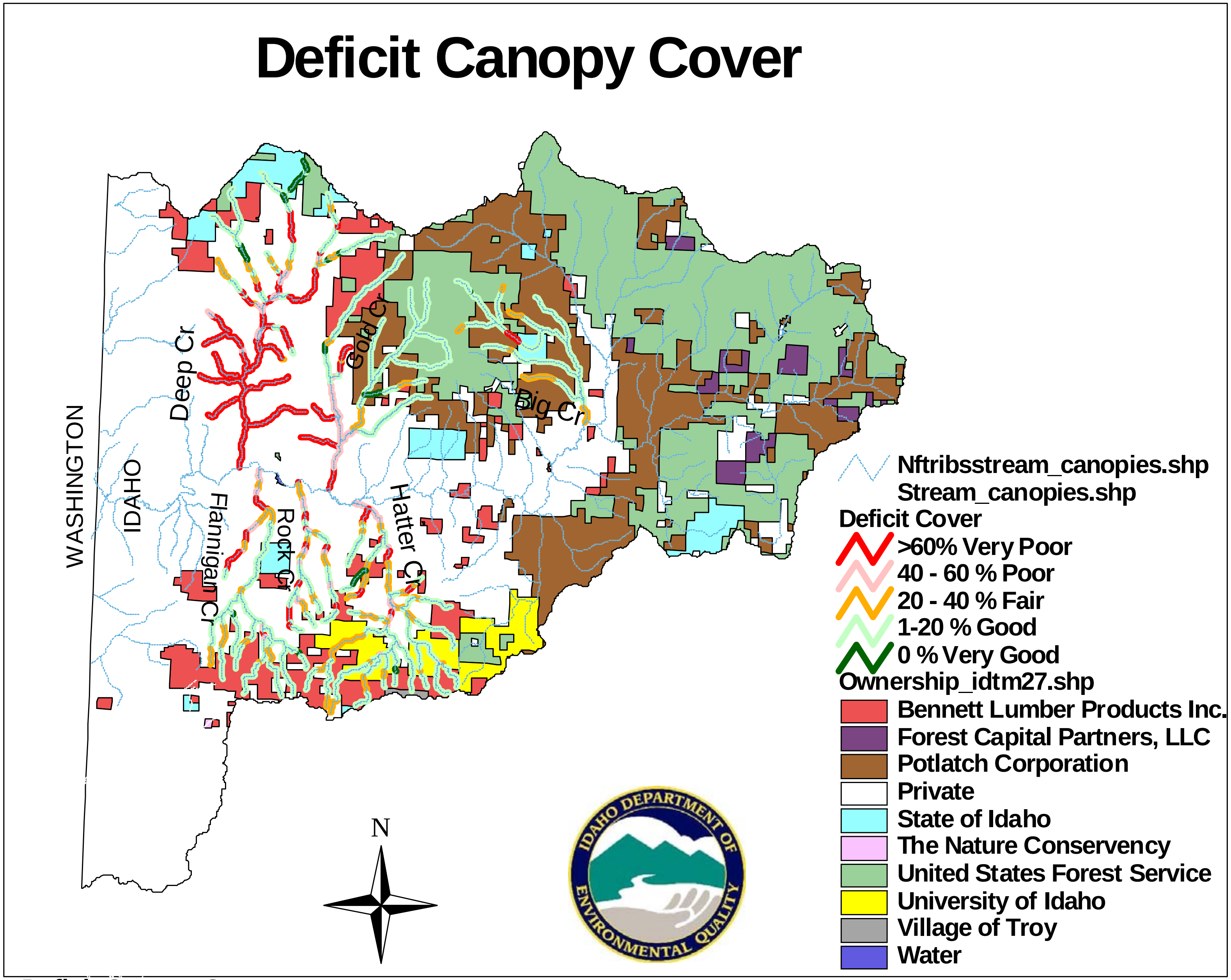
Soil #	Potential Cover %	Existing Cover %	Cover Condition Class	E – P / P * 100 (%)
Lower Deep Creek (AU# ID17060108CL032b_03)				
11	50	10	Poor	-80
11	50	10	Poor	-80
27	70	10	Poor	-86
27	70	10	Poor	-86
11	50	10	Poor	-80
11	50	10	Poor	-80
11	50	30	Fair	-40
11	50	20	Poor	-60
11	50	30	Fair	-40
Average	**54.4**	**15.6**	**Poor**	**-70.2**
Tributaries (8) to Lower Deep Creek (AU# ID17060108CL032b_02)				
27	70	10	Poor	-86
27	70	20	Poor	-71
27	70	10	Poor	-86
28	70	10	Poor	-86
27	70	10	Poor	-86
27	70	20	Poor	-71
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
27	70	10	Poor	-86
28	70	10	Poor	-86
28	70	10	Poor	-86
27	70	20	Poor	-71
28	70	10	Poor	-86
28	70	30	Poor	-57
28	70	10	Poor	-86
28	70	20	Poor	-71
28	70	30	Poor	-57
38	50	10	Poor	-80
38	50	20	Poor	-60
40	80	20	Poor	-75
40	80	60	Fair	-25
11	50	10	Poor	-80
9	70	70	Very Good	0
38	50	10	Poor	-80

38	50	20	Poor	-60
38	50	10	Poor	-80
38	50	70	Very Good	40
Average	**65.2**	**21.2**	**Poor**	**-69.3**
Upper Deep Creek (AU# ID17060108CL032a_03)				
38	50	30	Fair	-40
38	50	20	Poor	-60
Average	**50**	**25**	**Poor**	**-50**
East Fork Deep Creek (AU# ID17060108CL032a_02)				
38	50	30	Fair	-40
38	50	70	Very Good	40
38	50	20	Poor	-60
7	70	20	Poor	-71
7	70	60	Good	-14
7	70	30	Poor	-57
7	70	70	Very Good	0
7	70	10	Poor	-86
7	70	60	Good	-14
40	80	30	Poor	-62.5
31	80	80	Very Good	0
31	80	60	Fair	-25
31	80	80	Very Good	0
Average	**68.5**	**47.7**	**Fair**	**-30**
Middle Fork Deep Creek Including Tributaries (2) (AU# ID17060108CL032a_02)				
38	50	30	Fair	-40
7	70	20	Poor	-71
7	70	30	Poor	-57
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
7	70	50	Fair	-29
7	70	60	Good	-14
7	70	10	Poor	-86
7	70	20	Poor	-71
7	70	70	Very Good	0
7	70	80	Very Good	14
31	80	80	Very Good	0
7	70	40	Poor	-43
38	50	10	Poor	-80
38	50	70	Very Good	40
41	80	50	Fair	-37.5
41	80	70	Good	-12.5
38	50	60	Very Good	20
31	80	80	Very Good	0
31	80	90	Very Good	12.5
31	80	70	Good	-12.5

31	80	90	Very Good	12.5
Average	**69.5**	**54**	**Fair**	**-23.7**
West Fork Deep Creek and Tributary (AU# ID17060108CL032a_02)				
38	50	60	Very Good	20
7	70	70	Very Good	0
7	70	10	Poor	-86
7	70	50	Fair	-29
7	70	60	Good	-14
7	70	50	Fair	-29
7	70	80	Very Good	14
7	70	60	Good	-14
7	70	50	Fair	-29
7	70	60	Good	-14
7	70	70	Very Good	0
31	80	70	Good	-12.5
31	80	80	Very Good	0
31	80	70	Good	-12.5
7	70	70	Very Good	0
31	80	80	Very Good	0
31	80	80	Very Good	0
Average	**71.8**	**62.9**	**Good**	**-12.1**
Unnamed Tributary to Upper Deep Creek (AU# ID17060108CL032a_02)				
11	50	30	Fair	-40
7	70	30	Poor	-57
7	70	50	Fair	-29
7	70	20	Poor	-71
7	70	60	Good	-14
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
7	70	10	Poor	-86
7	70	70	Very Good	0
7	70	60	Good	-14
31	80	60	Fair	-25
Average	**68.9**	**43.3**	**Fair**	**-37.3**



Map E-1. Existing Canopy Cover



Map E-2. Deficit Canopy Cover

Appendix F. Rock Creek Informational Temperature TMDL

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Rock Creek Informational Temperature TMDL

Rock Creek is an intermittent stream and the only exceedance of the cold water aquatic life temperatures were after stream flows were below 1 cfs, therefore Rock Creek is meeting state standards for temperature. DEQ will propose to remove temperature as a possible pollutant for Rock Creek. DEQ included the temperature TMDL for Rock Creek as an informational TMDL only in this appendix. DEQ recommends that where possible the Rock Creek temperature TMDL be implemented. It is include in this document as a reference for future implementation work

Tables F-1 through F-3 display the existing load and load allocations for Rock Creek. Table F-3 list for each stream segment, the soil map unit number, the potential cover determined for each soil unit, the existing cover interpreted from aerial photos, and the difference between the two covers. Data are in order from the downstream end of the segment (usually the mouth) to the upstream end (usually the headwaters). The difference between the two covers is calculated by subtracting the potential cover from the existing cover, dividing the result by the potential cover, and converting to a percentage. The result reflects the difference between the two covers with a negative representing existing covers less than potential and a positive shows existing covers greater than potential. In some cases soils were not known, but were estimated based on surrounding watershed patterns. These soil units are marked with an "*". Map E-1 displays the existing canopy cover for each of the stream segments with landownership. Map E-2 displays the deficit cover in percentage and in condition classes with landownership. The main text of this informational temperature TMDL is located in Chapter Five of this document-temperature TMDLs.

Table F-1. Loads from nonpoint sources in Rock Creek Watershed.

Stream Segment	Average Existing Cover (Load)	Estimation Method
Lower Rock (AU #ID17060108CL012_03)	38.6%	Aerial Photo Interpretation
Lower East Fork Rock (AU #ID17060108CL014b_02)	41.7%	Aerial Photo Interpretation
Upper East Fork Rock (AU #ID17060108CL014a_02)	57.1%	Aerial Photo Interpretation
Lower West Fork Rock (AU #ID17060108CL013b_03)	44.3%	Aerial Photo Interpretation
Upper West Fork Rock (AU #ID17060108CL013a_02)	58.3%	Aerial Photo Interpretation
Lower Tributary to WF Rock (AU #ID17060108CL013a_02)	72.5%	Aerial Photo Interpretation
Upper Tributary to WF Rock (AU #ID17060108CL013a_02)	51.7%	Aerial Photo Interpretation

Table F-2. Load nonpoint source allocations for Rock Creek Watershed.

Segment	Average PNV (Load Capacity)	Average Existing Cover (Existing Load)	Average Cover Condition Class	Average Load Allocation #
Lower Rock (AU #ID17060108CL012_03)	55.7%	38.6%	Fair	-30.3%
Lower East Fork Rock (AU #ID17060108CL014b_02)	50%	41.7%	Good	See Appendix for stream segment analysis
Upper East Fork Rock (AU #ID17060108CL014a_02)	72.8%	57.1%	Good	See Appendix for stream segment analysis
Lower West Fork Rock (AU #ID17060108CL013b_03)	50%	44.3%	Good	See Appendix for stream segment analysis
Upper West Fork Rock (AU #ID17060108CL013a_02)	68.3%	58.3%	Good	See Appendix for stream segment analysis
Lower Tributary to WF Rock (AU#ID17060108CL013a_02)	77.5%	72.5%	Good	See Appendix for stream segment analysis
Upper Tributary to WF Rock (AU#ID17060108CL013a_02)	70%	51.7%	Fair	-24.2%

LA= ((Existing cover – Potential cover)/Potential cover) x 100. All 'Very Good' and 'Good' cover condition classes meet potential natural vegetation within limits of variability. See table F-3x for specific stream segments that may or may not meet these conditions.

Table F-3 Riparian Vegetation Cover

Riparian Vegetative Cover Analysis for Rock Creek

Soil #	Potential Cover %	Existing Cover %	Cover Condition Class	E – P / P * 100 (%)
Lower Rock (mouth to forks) (AU# ID17060108CL012_03)				
11	50	20	Poor	-60
7	70	50	Fair	-29
7	70	40	Poor	-43
38	50	60	Very Good	20
38	50	20	Poor	-60
38	50	60	Very Good	20
38	50	20	Poor	-60

Average	**55.7**	**38.6**	**Fair**	**-30.3**
Lower East Fork Rock Creek (AU# ID17060108CL014b_02)				
38	50	40	Good	-20
38	50	50	Very Good	0
38	50	60	Very Good	20
38	50	20	Poor	-60
38	50	30	Fair	-40
38	50	50	Very Good	0
Average	**50**	**41.7**	**Good**	**-16.7**
Upper East Fork Rock Creek (AU# ID17060108CL014a_02)				
38	50	50	Very Good	0
38	50	70	Very Good	40
59	80	70	Good	-12.5
59	80	40	Poor	-50
59	80	70	Good	-12.5
Soil #	**Potential Cover %**	**Existing Cover %**	**Cover Condition Class**	**E – P / P * 100 (%)**
59	80	20	Poor	-75
61	90	80	Good	-11
Average	**72.8**	**57.1**	**Good**	**-17.3**
Lower West Fork Rock Creek (AU# ID17060108CL013b_03)				
38	50	60	Very Good	20
38	50	50	Very Good	0
38	50	20	Poor	-60
38	50	40	Good	-20
38	50	50	Very Good	0
38	50	60	Very Good	20
38	50	30	Fair	-40
Average	**50**	**44.3**	**Good**	**-11.4**
Upper West Fork Rock Creek (AU# ID17060108CL013a_02)				
38	50	70	Very Good	40
38	50	20	Poor	-60
59	80	70	Good	-12.5
38	50	40	Good	-20
64	90	70	Fair	-22
64	90	80	Good	-11
Average	**68.3**	**58.3**	**Good**	**-14.3**
Lower Tributary to West Fork (AU# ID17060108CL013a_02)				
38	50	70	Very Good	40
59	80	70	Good	-12.5
61	90	70	Fair	-22
61	90	80	Good	-11
Average	**77.5**	**72.5**	**Good**	**-1.4**
Upper Tributary to West Fork (AU# ID17060108CL013a_02)				
59	80	70	Good	-12.5

38	50	70	Very Good	40
38	50	20	Poor	-60
60	80	70	Good	-12.5
60	80	10	Poor	-87.5
60	80	70	Good	-12.5
Average	**70**	**51.7**	**Fair**	**-24.2**

Appendix G. Unit Conversion Chart

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Table G-1. Metric – English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (gal) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 gal = 3.78 L 1 L= 0.26 gal 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 gal = 11.35 L 3 L = 0.79 gal 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (cfs)[a]	Cubic Meters per Second (m^3/sec)	1 cfs = 0.03 m^3/sec 1 m^3/sec = 35.31cfs	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L[b]	3 ppm = 3 mg/L
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 lb
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 °C = 37.4 °F

[a] 1 cfs = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 cfs.
[b] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water

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Appendix H. Distribution List

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Distribution List

Department of Environmental Quality – Lewiston Regional Office 1118 F St, Lewiston, ID 83501
Department of Environmental Quality – Grangeville Office, 300 W. Main St. Grangeville, ID 83530
Clearwater Basin Advisory Group (CBAG) members
Palouse River Tributaries Watershed Advisory Group (WAG) members
University of Idaho Library, Government Documents, University of Idaho, Moscow ID 83844
Lewis Clark State College Library, Lewis Clark State College, Lewiston ID 83501
Latah County Public Library, 110 S Jefferson Moscow, ID 83843
Palouse Clearwater Environmental Institute, P.O. Box 8596, Moscow, ID 83843
Potlatch City Library Potlatch, ID 83855
Marti Bridges DEQ- State Office 1410 N. Hilton Boise, ID 83706
Bill Stewart – EPA 1435 N. Orchard, Boise, ID 83706

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Appendix I. Public Comments

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Public Comments

Table I-1 summaries the public comments received. The public comment period was announced in two local newspapers- Lewiston Morning Tribune, and the Moscow-Pullman Daily News, and the was posted on the following websites:

http://www.deq.state.id.us/Applications/NewsApp/shownews.cfm?event_id=979

http://10.220.22.44/water/data_reports/surface_water/tmdls/palouse_river_tribs/palouse_river_tribs.cfm

The official public comment period ran from November 10, 2004 to December 10, 2004. A copy of the TMDL was sent to the following locations, groups and individuals for public review:

Department of Environmental Quality – Lewiston Regional Office 1118 F St, Lewiston, ID 83501
Department of Environmental Quality – Grangeville Office, 300 W. Main St. Grangeville, ID 83530
Clearwater Basin Advisory Group (CBAG) members
Palouse River Tributaries Watershed Advisory Group (WAG) members
University of Idaho Library, Government Documents, University of Idaho, Moscow ID 83844
Lewis Clark State College Library, Lewis Clark State College, Lewiston ID 83501
Latah County Public Library, 110 S Jefferson Moscow, ID 83843
Palouse Clearwater Environmental Institute, P.O. Box 8596, Moscow, ID 83843
Potlatch City Library Potlatch, ID 83855
Marti Bridges DEQ- State Office 1410 N. Hilton Boise, ID 83706
Bill Stewart – EPA 1435 N. Orchard, Boise, ID 83706

Four commentators submitted approximately 40 written comments. These comments were grouped for appropriate responses into technical, social and legal, and text comments.

Table I-1. Summary of Public Comments.

Commentator	Type of Comment	Date of Comment
Meg Foltz Hydrologist Palouse Ranger District Clearwater National Forest 1770 Hwy 6 Potlatch, ID 83855	Internet e-mail	November 18, 2004
William C. Stewart Environmental Protection Specialist EPA-Region 10 Idaho Operations Office 1435 N. Orchard St. Boise, ID 83706	Letter	December 7, 2004
Bill Dansart Latah Soil and Water Conservation District 220 E. 5th Street, Room 212A Moscow, Idaho 83843	e-mail- word attachment	December 10, 2004
Ken Clark Water Quality Analyst Idaho Association of Soil Conservation Districts 220 E. 5th Street, Room 212A Moscow, Idaho 83843	e-mail- word attachment	December 10, 2004

Technical Comments

Comment 1: Table C-G show temperature allocations, giving an average for each reach. This can be misleading by indicating some reaches are okay, when certain portions do have excessive temperatures. Appendix E gives more specific information. There should be a sentence or two in the Executive Summary indicating that the averages are given, but specific reaches may have different needs. Pages 148-152 do have footnotes with references to Appendix E but may need more work.

Response 1. The discussion in the executive summary and on pages 148-152 was re-worded to clarify the above point.

Comment 2: Could you explain how the targets for the bacteria were set.

Response 2. The target for the bacteria TMDLs is IDAPA 58.01.02.251.02 which states that, "Waters designated for secondary contact recreation not to contain *E. coli* bacteria significant to the public health in concentrations exceeding: a single sample of five hundred seventy-six (576) *E. coli* organisms per one hundred (100) ml; or a geometric mean of one hundred twenty -six (126) per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to five (5) days over a thirty (30) day period." The bacteria TMDLs were written for the month when an exceedance(s) occurred.

Comment 3. The analysis of potential natural vegetation in the document appears to be thorough and seems to give a good representation of natural shade potential. I was wondering if ground truthing of existing shade estimates was conducted and what the results of any ground truthing effort were?

Response 3. Ground truthing efforts were conducted at two stream segment locations within the Palouse River Subbasin. Using a spherical densitometer designed by Lemmon (1956) and following the modification by Strichler (1959), shade estimates were calculated and were within 10% of the existing shade estimates.

Comment 4: How was it determined that cover differences of up to twenty percent from potential natural vegetation would be considered good condition? How will this relate to attainment of water quality standards or a natural condition for temperature?

Response 4: The cover differences are averages for an Assessment Unit (AU) or major tributary within an AU, so cover differences in a ‘good’ condition still have reaches within them that have load reductions (shade increases). Another change was to call cover difference from zero to twenty percent a ‘fair’ condition. ‘Good’ conditions have reaches within an AU or major tributary within a AU, that averaged a positive difference above background, however, there are certain reach sections within these ‘good’ averages that received a load reduction, just as ‘poor’ AUs could have some reaches that meet shade requirements. See discussion on page xxiii in the executive summary for a more complete description.

Comment 5. In the margin of safety discussion on page 147 it is stated that the MOS is implicit because the design doesn’t take into account natural variation of the shading. Explain.

Response 5. The MOS is implicit because the shade targets that are in the TMDL are maximum shade percentages in a natural environment. For example in a natural environment there are fires, severe wind storms, and extended droughts that could decrease the amount of shade over a stream. Aspect, surface topography, precipitation zones (rain shadows) and other natural factors which could reduce the maximum shade potential were also not considered. In addition the shade targets were based on vegetation communities at their climax, (when trees, shrubs and grasses) were at their maximum potential shade. In a natural condition vegetation communities are not always at their maximum potential because of growth and other natural disturbances like fire. DEQ believes that for the above reasons the MOS is implicit, as the targets are set at the maximum natural potential.

Comment 6. What is the problem being caused by slightly elevated total phosphorus (TP) for Flannigan Creek and lower Hatter Creek? The same types of Best Management Practices that maybe needed to address the bacteria problem should be adequate to address the nutrient problem, if it exists, so perhaps a nutrient TMDL is not really necessary from a practical point of view.

Response 6. From a practical point of view you maybe correct, similar types of Best Management Practices (BMPs) will have to employed to achieve the bacteria, and nutrient TMDLs. In fact some of these BMPs will have a positive impact on the temperature and sediment TMDLs. However federal law requires DEQ to set a total maximum daily load for pollutants impairing beneficial uses. Elevated TP levels (two to three times above background) were recorded for extended period of time in Flannigan Creek and lower Hatter Creek which we believe is impairing beneficial uses

To answer your question the following is an excerpt from the nutrient discussion of beneficial uses for Flannigan Creek and lower Hatter Creek (pages 73 and 92):

A background level of 0.035 mg/L was established based on data collected at four reference watersheds. Based on background levels, DO trends, and other regional nutrient TMDL targets, a value of 0.10 mg/L total phosphorus (TP) was established as the load capacity for this TMDL during the growing season. In addition to the TP target, DO levels must remain above 6.0 mg/L during the growing season. The nutrient target is also based on a numeric state standard for dissolved oxygen requiring the level to be greater than 6.0 mg/L at all times, and a narrative target stating that surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. DEQ believes that by keeping TP levels below 0.10 mg/L, and by increasing stream flows, DO levels should remain above 6.0 mg/L and thereby not impair beneficial uses. Low summer flows contributed to the low DO readings in Flannigan and lower Hatter Creek. To improve the low summer flow condition, water could be retained during the spring runoff in new or improve wetlands and riparian corridors. The water would then be stored at the surface or in shallow groundwater areas and released during the low summer flow periods and thereby improving the DO situation.

In Flannigan Creek the nutrient target was violated a total of eleven times between both monitoring sites. The phosphorus target was violated a total of ten times, five at each site. Samples were collected from both upper (PR17) and lower (PR16) monitoring sites as outlined in the monitoring plan (Appendix A). Data from the lower site revealed six consecutive bi-weekly exceedances of the nutrient target, five TP reading above 0.10 mg/L and one DO level reading below 6.0 mg/L (Table 2-21). Data from the upper site revealed four consecutive bi-weekly exceedances of the nutrient target including four consecutive TP reading above 0.10 mg/L. Some aquatic plant growth was noted in Flannigan Creek. Based on the frequency and duration of the TP and DO exceedances a TMDL for nutrients will be written for Flannigan Creek.

In Hatter Creek the nutrient target was violated a total of five times between at the lower monitoring site. The phosphorus target was violated a total of three times consecutively and the DO target twice. The violation of 0.8 mg/L on 6/18/2002 is several orders of magnitude larger than the other results, and this could have been an error at the lab after collection or an error committed sometime during the preparation (perhaps in the sample container) during collection or during the transportation and transfer of the sample. DEQ does not consider this to an accurate reading. Even without this reading, there were two other consecutive bi-weekly exceedances of the TP target and three continuous bi-weekly DO exceedances.

Based on the frequency and duration of the TP and DO, field reports, and site visits, DEQ believe a nutrient problem exists in Hatter Creek-lower and will write a nutrient TMDL for the lower section of Hatter Creek.

Comment 7. Page 107 under sediment. Immediately following this paragraph, within the section that discusses the various models used, it would be useful to discuss the uncertainty and limitations of modeling (accuracy, variability, requirements for calibration and verification, and ranges of acceptable error in the results) in a general way to allow readers who don't have direct experience with modeling to put the results reported in proper context relative to actual or observed watershed conditions. For example, without that perspective, some load reductions called for in the TMDL, such as the 96% reduction in sediment called for in the Deep Creek watershed, may strike some readers as odd, at best, as well as unobtainable.

It would also be useful to point out throughout the document that the ultimate measure of whether a TMDL Implementation effort is successful is determined by the in-stream determination that the water quality standards and/or targets are met, not whether the load reduction targets are met. Also point out that load allocations and targeted reductions are based on very limited actual in-stream water quality data collection and will vary from year to year depending on the annual discharge rates.

Response 7. The following discussion regarding the use of models was added to page 107. "Some general notes on modeling, including sediment modeling. All models inherently have some range of error associated with them, some even around 50% or more. The exact output or end result of a model are not necessarily the most important feature, but observing trends over a unspecified period of time are perhaps more important. For water quality, streams must meet beneficial uses regardless of the output or percent reduction the model(s) predicted. It could be possible to meet the beneficial uses and not meet the exact percent reduction within a model, and conversely the reverse is true. Models were used in a fairly reliable and repeatable process to obtain an estimate of the amount of a specific pollutant in order to create a TMDL. DEQ believes the models used in this report can be used again after an unspecified period of time or several times in the future to observe trends in a pollutant. As with all technologies and within the field of science itself, new ideals, principles and beliefs will inevitable come, therefore new models or new methods could possible be used to solve issues addressed within this document."

Comment 8. . Please explain why the C-factors used from meadow, CRP, hay, and pasture are higher than those for grass?

Response 8. A USDA and NRCS report was referenced for the C factors for meadow, CRP, hay and pasture and believes these C factors more accurately describe the conditions of the ground.

Comment 9. Please discuss the uncertainties in the sediment model.

Response 9. The following discussion regarding the use of models was added to page 107. "Some general notes on modeling, including sediment modeling. All models inherently have some range of error associated with them, some even around 50% or more. The exact output or end result of a model are not necessarily the most important feature, but observing trends over a unspecified period of time are perhaps more important. For water quality, streams must meet beneficial uses regardless of the output or percent reduction the model(s) predicted. It could be possible to meet the beneficial uses and not meet the exact percent reduction within a model, and conversely the reverse is true. Models were used in a fairly reliable and repeatable process to obtain an estimate of the amount of a specific pollutant in order to create a TMDL. DEQ believes the models used in this report can be used again after an unspecified period of time or several times in the future to observe trends in a pollutant. As with all technologies and within the field of science itself, new ideals, principles and beliefs will inevitable come, therefore new models or new methods could possible be used to solve issues addressed within this document."

Social and Legal Comments

Comment 1: Page 27 under livestock and grazing: delete this portion of the first sentence, 'that are too small to be called an Animal Feeding Operation (AFO) or a Confined Animal Feeding Operation (CAFO). Add this instead, 'In addition several animal feeding operations (AFOs) exist. These AFOs are used primarily for winter feeding and calving of livestock that graze other areas during the remainder of the year.'

Response 1: We agree, your suggestions more accurately describe the condition on the ground. Changes made.

Text Comments

Comment 1. Page 13 under Erosion, second paragraph, Reference is to Table 1-2, but it should be Table 1-3.

Response 1. Correction has been made.

Comment 2. Page 22 under Land Use, first paragraph, misspelled barley, and reference is to Map 1-6, it should be Map 1-5.

Response 2. Corrections have been made.

Comment 3. Page 23 under Forestry, Reference is to Table 1-3 but should be Table 1-4. (which gives board feet).

Response 3. Correction has been made.

Comment 4 Page 28 under Transportation, reference is to Map 1-7, it should be Map 1-6.

Response 4. Correction has been made.

Comment 5. Page 29 under Land ownership, reference is to Map 1-8, it should be Map 1-7.

Response 5. Correction has been made.

Comment 6. Page 80 map is labeled Big Creek (on the map), should be Gold Creek as the stream is named on the map.

Response 6: Correction has been made.

Comment 7. Page 3, sec 1.1 paragraph 2, line 3: Replace cold water with cold water aquatic life.

Response 7. Correction has been made

Comment 8: Page 16, Map 1-4. Add a 303(d) listed stream symbol in the legend. On the northeast portion of the map it appears that the quaritize and schist geologies end in an unnatural manner (straight line), please explain.

Response 8. This is the geology GIS layer that DEQ has, and we believe the unnatural look, represents where a soil or geology survey may have ended.

Comment 9: Page 22, sec 1.3 Land use paragraph 2, last line: Insert year for (Cook and Hufford) reference. Line 8: Replace comma after ‘ground’ with a semicolon.

Response 9. Inserted the year and reworded for clarification.

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